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There Is Room for Improvement in Bearing Maintenance Practices

ON MANY electric railways the interval between the times that it is necessary to give attention to bearings determines the overhauling and inspection periods for the rolling stock. Long life of bearings is, therefore, most essential. This issue of ELECTRIC RAILWAY JOURNAL contains the first of two survey articles relating to bearing practice. Information has been collected first hand by personal inquiries of the editors as to the methods used in preparing bearings for use before they are machined and refitted to the rolling stock.

The use of bearings consisting of a shell of bronze, iron or steel with a wearing surface of a soft tin or lead base metal is nearly universal in this country. In order to obtain satisfactory service from such bearings, close attention to their preparation is necessary. The three most important essentials are a good grade of babbitt metal, absolute cleanliness and close attention to the temperature at which the metal is worked. A satisfactory bearing can be produced only by a skilled workman using proper methods and suitable equipment.

Regardless of its qualities, babbitt will give but indifferent results unless poured at close to the right temperature. When overheated, babbitt loses part of the constituents essential to long service, and if poured too cold, it cannot produce a bearing of satisfactory texture. The survey shows that not enough attention is being given to this important detail. Less than one-third of the railways visited had melting pots equipped with temperature control. The method most commonly used for determining temperature consists of inserting a pine stick in the hot babbitt. If the stick catches fire the metal is assumed to be hot enough for pouring. While this test is crude enough, there is no test for overheating. Even the "pine-stick" test is seldom made.

Particular attention has been given, in most cases, to the quality of new babbitt metal purchased, but frequently insufficient care is exercised to keep the metal pure. Impurities enter through lack of attention in cleaning out the old babbitt from shells, in keeping the new metal in the pots free from contamination, in using dirty ladles and babbitting jigs and in careless work while tinning the shells. Some master mechanics who have had analyses made of babbitt metal taken from bearings have been surprised to find traces of iron and other metals foreign to the original mixture. For armature bearings, it is folly to attempt to mix new metal with old. An unsatisfactory bearing is sure to result.

Failure of bearings in service should be followed by a careful investigation and analysis of the methods and equipment being used in the babbitting department. Closer attention to the essentials may prevent the trouble and produce substantial savings, to say nothing of greater regularity of service—for in the end that is what counts.

Good Work by All Will Help Pay High Wages

AN EDITORIAL in these columns recently called attention to increases which have taken place in electric railway wages during the past twelve months. If the present high wages are to continue, the only way in which they can be paid is for the men to give the companies the very best and most loyal service within their power. They can help in many ways.

This help need not go so far as to advance the interest due on the bonded indebtedness of the company when its treasury is low, or of purchasing a large block of stock so as to vote into office a popular group of directors, though both of these things have been done by electric railway employees within the last few years. There are less spectacular but equally effective ways of helping the company's finances.

One way is to operate as economically as possible so as to keep down operating expenses. This means care in using power and supplies; care in operating without accidents to persons and property; notifying some responsible officer of the company of leaks which may be noticed in the expenditure and of defects which may be discovered in the equipment, so that they can be corrected promptly; of speeding up the service so that a greater number of car-miles can be operated in the same number of car-hours, etc.

It also means assistance to the company in increasing its gross receipts, as by courteous and attentive treatment of passengers on the car, of being on the lookout for waiting passengers, of standing up for the company and its policies in public and private meetings and at the polls if necessary, in helping to impress the public with the idea that an efficient and enterprising electric railway is an asset to every community and that the only way in which such an asset can be had is by fair treatment of it by the public.

The suggestions just made apply primarily to the platform man, but it is obvious that good work from the men in the shops, power station, construction force and offices is equally necessary. It should be a case of all pull together.

This applies also to the executive force, for it should be recognized that nothing is so effective in good team

This is the issue in August that is devoted essentially to maintenance subjects

work as the cordial co-operation and interest of the management. On a certain property, a platform man on one of the outlying divisions recently remarked that he had been with the company eight years, and during that time he had not seen any of the officials of the company at his division headquarters, with the exception of the master mechanic and the division superintendent. On another property, not far away, the general manager knew by sight practically every one of the 1,800 employees on the property and could call most of them by name. Although a good memory for faces and names is largely a gift, there is no reason why all the men should not at least know the manager by sight and feel that they can talk things over with him when they wish to do so. It is part of his job to have them know him, and his work will be accomplished far better if they are working with him.

Getting the Best Results from Reclaimed Oil

THE familiar quotation from Benjamin Franklin, "He has paid dear, very dear, for his whistle," shows that there has always been a tendency to misapply certain products or practices to uses for which they are not economical. The use of old material or reclaimed material for purposes to which it is not suitable in electric railway maintenance, may cost more in the long run than new material particularly adapted to the use desired.

The work of reclamation is to be commended and should be encouraged, but care should be used in applying the material not to put it to an inferior use or one for which it was not originally intended. In a recent survey article published in ELECTRIC RAILWAY JOURNAL mention was made of the fact that several railways were using reclaimed oil for various purposes. In a communication published in this issue of the JOURNAL it is pointed out that for many of the uses to which reclaimed oil was said to be put the particular type of lubricant was not suitable. Reclaimed oils of straight mineral character can be used for the same purposes as those for which the new oil was initially used, and with equal or even better results, but the benefits of reclamation may be lost through misapplication.

This illustration serves to bring out the point that master mechanics should consider the suitability of any material to be used as well as its initial cost as compared with that of new material. The manufacturers' engineers often spend considerable time and thought determining the particular product that will meet the railways' conditions most satisfactorily. If something unsuitable is substituted troubles and delays may occur that will prove far more expensive than the initial cost of the right material.

Systematic Inspection Pays Handsome Dividends

NO MATTER how good the component parts of electric railway equipment may be when purchased, they cannot continue to function indefinitely without proper inspection and repair. Both of these are important. Continuity of service, the aim of any management, depends on finding the possible failures before they occur and so repairing the parts that the cause leading to a failure is either removed or its effects counteracted so that the part can function successfully.

The efficiency of the car inspection department can be judged directly by the public in the number of failures or delays which occur in service. These are the result of the defects missed due to lack of inspection or improper repair of the parts inspected and found unfit. As a rule failures of this sort, if more or less regular in their occurrence, indicate that the inspection has been slighted, either through inefficiency of the force or through a short-sighted policy of the management in saving money for the moment.

A few illustrations will show that trivial causes may result in serious disruption of the service. In going over the records of one railway, several items appeared as causes of delays that would not have been possible with proper inspection. One of these was the wedging of doors due to worn races. Delays occurred at nearly every stop, so that the car ran considerably behind its schedule. Another delay was caused by a burnt-out lamp in the headlight circuit. This minor failure was allowed to go unnoticed until it was time to turn on the headlight. The result was considerable delay due to replacing the lamp. The two delays in question spoiled a monthly record that otherwise was excellent. They serve as a good example of the value of making sure that the inspection is carried through at the time designated, and that the repairs are carried out immediately when they are found to be necessary.

Clean Cars Increase Riding and Deteriorate Less Rapidly

THE many railways which are now making a special feature of keeping their cars clean and advertising this fact to their patrons report good results from such campaigns. Certainly the cleaner and better-looking cars are kept, the greater will be the attractiveness to car riders.

There still is room for improvement in methods of car cleaning on a large number of railways. If cars are to be kept clean, they should be washed frequently outside. To do this without considerable cost proper washing equipment is needed. One of the most efficient methods that has been used in a large number of shops and is being installed in many of the shops which are giving special attention to car cleaning consists of a washing section with perforated pipes connected to the city water system. Tracks set aside particularly for car cleaning are provided with proper drainage so that the car can be run through the spray from the pipes as many times as needed, while men with brushes clean the windows and woodwork.

Another chance for improvement in cleaning practices is in the interior of the cars. Vacuum cleaning equipment has been used by several electric railways. The principal trouble experienced is that railways have attempted to use for this purpose equipment not particularly well adapted to the needs. There are several vacuum cleaners on the market, however, which have been worked out particularly for installation in shops where such work is done.

Aside from the increased riding and the merchandising value of clean, attractive cars, deterioration usually takes place more slowly. The dirt in corners collects moisture and leads to decay of posts and window framing on wooden cars and to rusting of various parts on steel bodies. By keeping cars clean such parts need less attention to keep them in repair and repainting can be done at less expense. Modernization in this respect will give results well worth the outlay.

Survey of Armature, Axle and Journal Bearing Practice

First Article

An Analysis of Types of Bearings Favored, Methods of Determining Wear and Removal of Bearings, Removing Old Babbitt, Cleaning and Tinning Shells, Babbitt Composition, Mandrels, Pouring the Babbitt—Practices of 20 Electric Railways Disclosed by Personal Visits of Editors Are Summarized

Babbitting Department of the Third Avenue Railway, New York City

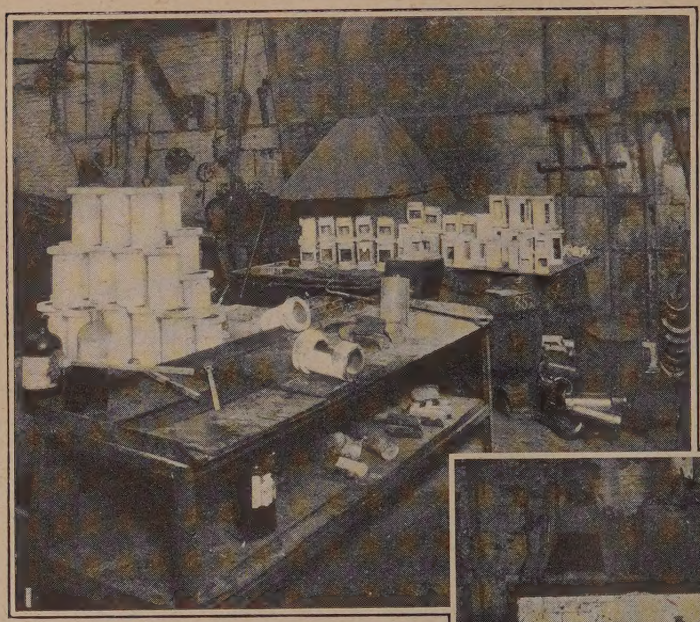
REALIZING that the time between overhaulings of electric cars is governed principally by the life of the various bearings, a special study has been made of the bearing practice on twenty representative electric railways by personal visits of the editors of ELECTRIC RAILWAY JOURNAL. The practices found are in general quite uniform, but of course vary with the different types of equipment used and also with the types of bearings which are operated.

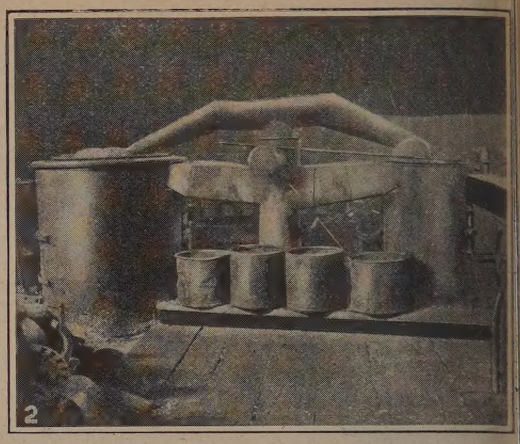
Most of the electric railway properties were found to have three types of bearings in service. These were (1) babbitted cast-iron or malleable-iron shells, (2) babbitted bronze or brass shells, and (3) solid bronze bearings. There is a general tendency away from the use of the babbitt-lined iron bearings, and either babbitt-lined bronze or solid bronze bearings are being substituted for those with iron shells. Of the 20 electric railways from which information was obtained, 12 were using all three types of bearings. Eight companies were using babbitt-lined bronze or solid bronze bearings exclusively. These are the Long Island Railroad; New York Central Railroad; Toronto Transportation Commission; Niagara, St. Catharines & Toronto Railway; Youngstown Municipal Railway, Illinois Traction, Inc., New York, Westchester & Boston Railroad, and the New York, New Haven & Hartford Railroad.

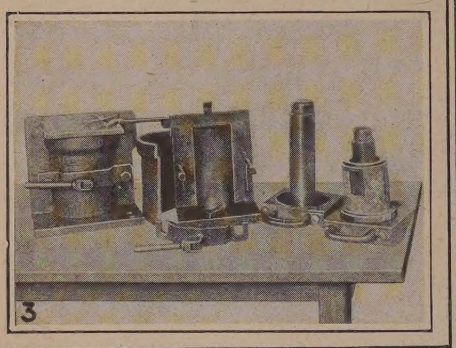
The bearing practice of electric railways is readily divided into five distinct operations: (1) Removal of the bearings from the cars, their gaging for wear and to determine their suitability for rebabbitting in order to return them to service; (2) removal of the old babbitt and preparation of the shells for rebabbitting; (3) where a babbitt lining is used, relining the shells with babbitt; (4) machining the bearings, cutting oil grooves and other work necessary to produce a finished bearing and (5) reinstalling the bearings in cars and making sure that proper fits are obtained. The first three of these operations will be analyzed in this article, and a subsequent article will deal with the machining and fitting of bearings after they have been babbitted.

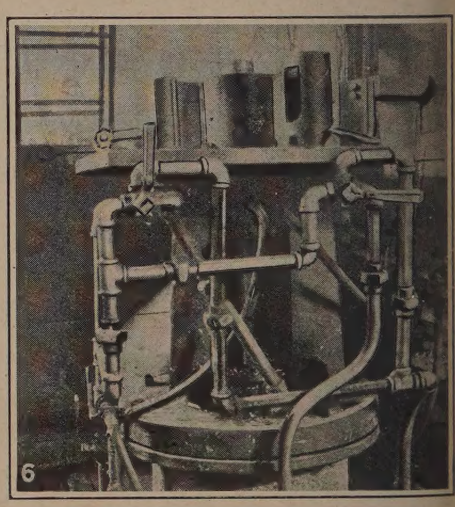
TESTING MOTORS FOR ARMATURE CLEARANCE

As bearings do not wear uniformly, most electric railways find it necessary to check up the clearance between the armatures and the motor pole faces as a matter of regular inspection. The most common method of determining the clearance is to insert feeler gages of various thickness. Whenever a motor has so small a clearance that the thinnest of the feeler gages is the only one that can be inserted, the car is ordered in and the bearings are replaced. The thickness used for the thinnest gage was found to vary on the railway properties visited from a minimum of 0.02









Representative Babbitting Equipment and Methods Used

No. 1. On the Third Avenue Railway, New York City, all bearings are painted with whiting before tinning, so that the tin will not adhere where it is wanted.

No. 2. A pair of babbitting metal furnaces used in the shops of the United Electric Railways, Providence, R. I.

No. 3. Several types of babbitting jigs used by the Eighth Avenue Railroad, New York, N. Y.

No. 4. Armature-bearing babbitting bench in the Third Avenue Railway shops showing various types of bearings and jigs used.

No. 5. Babbitting jigs used for babbitting truck journal bearings in the shops of the Third Avenue Railway.

No. 6. Molding machine used for solid bearings in the shops of the United Electric Railways, Providence, R. I. A water-cooled arbor projects through an iron table. In operation the arbor is elevated by a manipulation of two three-way valves. The mold is placed over and around it and the babbitt is poured and cooled in about a minute's time.

n., used by the Omaha & Council Bluffs Street Railway, o 0.09375 in. on the Brooklyn-Manhattan Transit Corporation. On the majority of the roads the thinnest gage was approximately $\frac{3}{32}$ in. Nearly all of the railways test for both top and bottom clearance, but the bottom clearance is the only one considered when replacing bearings. In addition to replacement for wear, bearings, of course, are removed when the equipment is overhauled, and in most cases the practice is o replace them with newly fitted ones.

After the bearings have been removed, the wear both nside and outside the shell must be determined and hose bearings which are excessively worn and which annot be rebabbitted with safety must be discarded r scrapped. The Third Avenue Railway and the Brooklyn-Manhattan Transit Corporation use snap gages for determining the wear on the outside of the various types of bearings. As soon as the bearings are removed, they are gaged, and if the snap gage for that particular type passes over the bearing, it is rejected. On some of the smaller railway properties, the suitability of a bearing shell for rebabbitting is judged entirely by looking at the shell and determining its thickness. Of course the inside lining of the shell can be rebabbitted so as to provide a proper fit for the axle, but the outside wear can only be taken up by using shims between the bearing and housing or by building up and remachining the parts which fit together. The various methods used and results obtained will be considered in the second article.

The next operation is that of removing the old babbitt and preparing the shell for rebabbitting. In most railway shops there is a pot with old babbitt and the bearings are dipped in this until the temperature is high enough to melt out the lining. In Toronto the lining is melted out in a special gas furnace so that the metal is run off into molds as soon as it melts, preventing overheating and burning. The removal of babbitt metal by the use of a hammer and chisel has been quite generally discarded, as this not only entails considerable labor, but there is danger of damaging the shell. It is also a difficult matter to chip babbitt from anchor holes and grooves.

Circular Benches Around the Babbitting Pot Make a Convenient Arrangement in the Eastern Division Repair Shop of the Brooklyn-Manhattan Transit Corporation

Cleaning the Shells an Important Element

After the old babbitt has been removed, the next step is to clean the shells of all dirt, sand, scale, rust, oil and grease. Oil and grease are quite generally removed by burning or by dipping in the babbitt pot. Sand, scale and rust are most frequently removed with a wire brush or a stiff bristle brush. On the Third Avenue Railroad and the Georgia Railway & Power Company the bearings are sand blasted. Oil and grease are sometimes removed by dipping the bearings in saturated caustic soda solution. In Omaha the bearings are boiled in Wyandotte alkaline solution manufactured by the J. B. Ford Company, Wyandotte, Mich., after they are brushed off. The pickling of bearings by immersing them in dilute sulphuric acid is not generally practiced except where they are in bad condition. Where acid dips are used, they should be followed immediately by a thorough washing of the bearings in clean water.

For the information of those who find it desirable to clean their shells in some sort of solution, a sulphuric acid solution which produces satisfactory results can be made by taking 10 gal. of 66 deg. B. commercial sulphuric acid to 100 gal. of water. The specific gravity of this solution is 1.072 at 86 deg. F. and 1.08 at 154 deg. F. Best results are obtained by maintaining this solution at a temperature of from 140 to 176 deg. F. when in use.

A satisfactory hydrofluoric acid solution can be made in the proportion of 11 gal. of 16 deg. B. commercial hydrofluoric acid to 100 gal. of water. The specific gravity of this is 1.015 at 61 deg. F. and 1.005 at 124 deg. F. This solution should be maintained at a temperature of 104 to 140 deg. F. while in use, and should be replaced when it takes on a brownish color.

Tinning Bronze Shells

Where bronze or brass shells are used for bearings, it is the universal practice to tin the surface to be babbitted to hold the lining firmly in place. Cast-iron and malleable-iron shells are not tinned, but dovetail grooves or anchor holes are used for retaining the babbitt. The tinning practice includes three principal methods. The larger electric railways, such as the Chicago Surface Lines, the Milwaukee Electric Railway & Light Company and the Third Avenue Railway, which have many shells to be tinned at one time, invariably dip them into a pot of hot solder, which is maintained at a temperature of from 792 to 824 deg. F. The smaller electric railways such as the Eighth Avenue Railway and the New York & Queens County Railway, usually apply the solder by taking a bar and melting it with a hot soldering iron or else by heating the shells and applying the solder to the parts which are to be tinned, which is standard practice in Memphis and Atlanta. The hot shell then melts the solder. Of

course it is necessary to use a flux on the parts to be tinned. This usually is a saturated solution of zinc in hydrochloric acid. The most common method of applying the flux is to swab it on.

Where shells are dipped in the soldering pot, it is necessary to coat the parts which are not to be tinned with some mixture which will prevent the tin from sticking where it is not desired. The most common material used is whiting or chalk. In Milwaukee a mixture of fireclay and water is used. Some railways use a thin mixture of graphite and water. After the parts have been coated and the flux applied, they can be dipped in either the soldering pot or in the babbitt pot and they should be left in until they are just hot enough for the molten metal to run off. After they are removed, it is the general practice to rub with the zinc chloride solution so as to make sure that there are no untinned spots left on the surface to be babbitted. In Brooklyn it is the practice to dip new shells twice in the solder where they have not been tinned previously.

After the tin has been properly applied, the surface should not be touched, but should be babbitted immediately. Possibly the most common mixture used for tinning is plumber's solder, half tin and half lead, although some roads vary these proportions. One manufacturer recommends using 35 per cent tin and 65 per cent lead. The Milwaukee Electric Railway & Light Company uses 90 per cent tin and 10 per cent lead. It is stated that the small quantity of lead is used in order to prevent contamination of the babbitt with the lead from the tinning.

Babbitting the Bearing

It is the usual practice to follow with the babbitting while the shells are still hot from the tinning operation, the babbitting jigs and mandrels having been previously prepared to receive the shells. Of the 20 railways from which information was obtained, 14 followed this method. In Memphis, Omaha and Milwaukee, the bearings are placed on a shelf around the babbitting furnace. The New York Central Railroad and the New York & Queens County Railway preheat by means of a torch. In Toronto shells are preheated in the furnace used for melting out old babbitt. The mandrels are preheated to prevent chilling of the babbitt when it is poured. The usual method of doing this consists of standing the babbitting jig on a shelf adjacent to the babbitting pot. Some railways have babbitting furnaces with ovens and the jigs and mandrels are placed in these for preheating. Mandrels for solid bronze shells should be heated to approximately 212 to 257 deg. F. and split bronze shells are usually heated to a somewhat higher temperature. Mandrels for use with malleable iron shells are sometimes heated to as high as 572 to 662 deg. F. Where bearings are tinned and then set away before the babbitting operation, it is of course necessary to preheat them specially before the babbitt is applied.

The mandrels are made with an allowance for boring the rebabbitted bearing. The information obtained shows that this allowance varies from $\frac{1}{16}$ in., which is used in Omaha, to $\frac{3}{8}$ in., which is allowed by the New York & Harlem Railroad. The majority, however, make an allowance of $\frac{1}{8}$ in. under that of a new shaft. Most electric railways are using undersized shafts for some motors. Where bearings are fitted to these, of course, a smaller amount of the babbitt is bored out.

TABLE I—BABBITT COMPOSITION AS USED ON 20 ELECTRIC RAILWAYS

Company	Composition in Per Cent Tin	Lead	Anti-mony	Copper	Remarks
Brooklyn-Manhattan Transit Corporation	83⅓	....	8⅓	8⅓	.....
Chicago Rapid Transit Co...	89	....	7	4	.....
Chicago Surface Lines.....	83⅓	....	8⅓	8⅓	.....
Denver Tramway					
Armatures.....	...	...	...	..	More-Jones metal
Axles, old standard.....	86½	3	7	3½	.....
Axles, new standard.....	22	64½	13	½	.....
Eighth Avenue Railway					
Armatures.....	...	....	...	..	More-Jones metal
Journals.....	...	....	...	..	Brill and More-Jones
Georgia Railway & Pwr. Co.					
Armatures.....	...	....	...	..	Westinghouse metal
Axles and journals.....	...	....	...	..	More-Jones metal "Regent"
Illinois Traction, Inc.....	86	....	9	5	.....
Long Island Railroad					
Armatures and axles.....	85	....	...	..	Antimony and copper to make 100 per cent
Journals.....	...	....	...	..	Zero metal
Memphis Street Railway...	...	....	...	..	More-Jones metal
Milwwukee Electric Railway & Light Company, The..	83⅓	....	8⅓	8⅓	.....
New York Central Railroad					
Armatures and axles.....	...	....	...	..	Tin base
Journals.....	...	....	...	..	G. E. lead base
New York & Harlem R. R....	...	....	...	..	Tin base
New York, New Haven & Hartford Railroad.....	...	....	...	..	Tin base
New York & Queens County Railway.....	...	....	...	..	Tin base
New York, Westchester & Boston Railroad.....	83⅓	....	8⅓	8⅓	.....
Niagara, St. Catharines & Toronto Railway.....	...	....	...	..	Hoyt's formula
Omaha & Council Bluffs Street Railway					
Armatures.....	84	....	10	6	.....
Axles.....	5	80	15	..	.....
Third Avenue Railway.....	...	....	...	..	Tin base
Toronto Transportation Commission.....	83⅓	....	8⅓	8⅓	.....
Youngstown Municipal Ry..	...	....	...	..	Special nickel-bronze

Some railways take special precautions to prevent the sticking of the babbitt to the mandrel and also to prevent blowholes in the babbitted portions. It seems to be quite general practice to provide the mandrels with a slight taper to assist in their removal, and to keep them highly polished and oiled frequently. Some reported that they paint the mandrels with graphite and oil every morning before starting to pour the babbitt. The Brooklyn-Manhattan Transit Corporation uses a solution of fireclay and dips the mandrels in this solution about every fourth pouring. This railway also states that the use of fireclay materially assists in preventing blowholes, as it gives a very smooth finish to the babbitted portion. The majority of railways, however, report that no special precautions are taken with the mandrels to prevent blowholes, but they make certain that the babbitt is thoroughly mixed by agitating the molten metal just previous to filling the ladle. Blowholes are frequently caused by damp or wet mandrels or dampness in the bearings themselves. If the mandrels and bearings are carefully preheated they naturally will be dry.

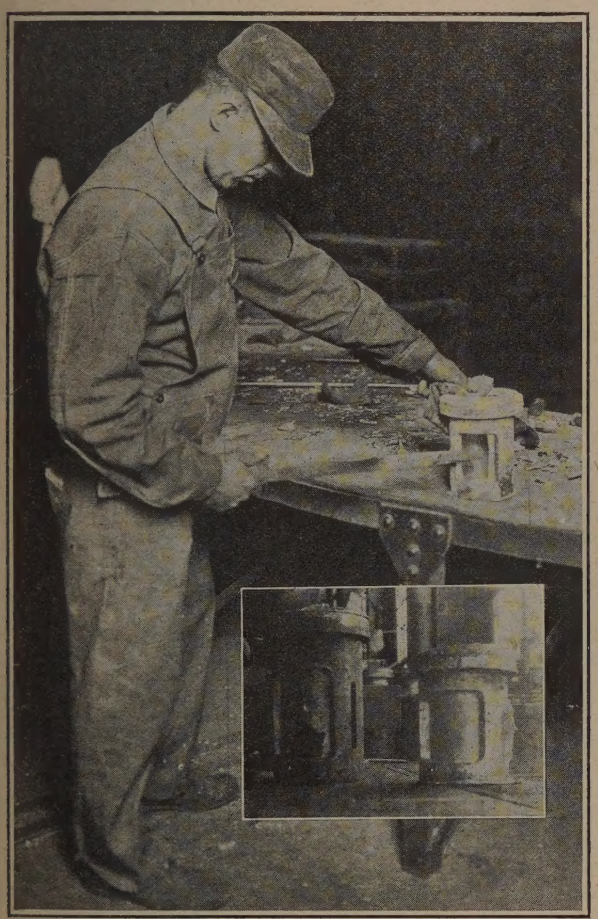
Formulas Used for Babbitt

A large variation was found to exist in the formulas used for babbitt by the different railways. The majority of those visited, however, preferred a tin base babbitt metal. Of the railways using the tin base metal, the percentage of tin varies from 83⅓ per cent to 86 per cent, with antimony varying from 8⅓ per cent to 10 per cent, and copper varying from 4 to 8⅓ per cent. The formula frequently referred to as genuine babbitt is quite commonly used. This consists of 83⅓ per cent tin, 8⅓ per cent antimony and 8⅓ per cent copper. The composition used by each of the companies included in the survey is given in Table I.

Several of the railways using a tin base babbitt metal exclusively for their armature bearings include a small

amount of lead for their axle and journal bearings and obtain good results. The small railways are nearly all buying standard babbitt metal as furnished by the various manufacturers. These include a great many varieties with special trade names and distinctive qualities. They usually contain from 80 per cent to 90 per cent of tin or lead as their principal element. The larger railways, however, make their own babbitt metal according to the proportions which they find most satisfactory.

Of the railways from which information was obtained, fifteen reported that they used old babbitt, while five, including the Chicago Surface Lines, the New York Central Railroad and the Long Island Railroad, make



After Pouring the Babbitt, Various Fins and Excess Babbitt Around Windows and at Edges as Shown in the Insert Must Be Removed. This Can Be Done Most Conveniently by Use of a Hot Iron as Shown

no use of second-hand babbitt. Of those using old babbitt, six use this for all bearings, four use it only for axle bearings, four use it for both journal and axle bearings, and one railway employs the babbitt for miscellaneous uses such as sash weights and other parts of similar nature required about the shop. The Chicago Surface Lines returns the old metal to the manufacturer for reconditioning.

The temperature at which babbitt metal is poured into the bearing is vitally important. Manufacturers recommend that the babbitt metal be not allowed to become hotter than 914 deg. F. Information obtained in this survey indicates that temperatures ranging from 700 deg. to 900 deg. F. are used, but as more than half of the properties were using babbitting pots not equipped with pyrometers, accurate information was not available. Railways which do not have pyrometer equipment in connection with their babbitting furnaces quite commonly use a pine stick for determining the temperature of the babbitt. If the stick starts to blaze when it is inserted in the babbitt pot the metal is considered to be at a sufficiently high temperature to pour. Of the railways visited, only six had babbitting departments equipped with pyrometers. All, however, realize the advantages of temperature control and several expect to install it soon.

The babbitt metal should be agitated at frequent intervals and always just before using, particularly if it has been standing in a molten condition for a considerable length of time. Where the babbitt pot is used infrequently, a covering of charcoal is frequently used to prevent the formation of dross. A common method of supplying this is to add a few handfuls of sawdust or oak shavings. The hot metal, setting fire to this, produces a covering of charcoal. The New York Central Railroad prevents oxidation by throwing a handful of sal-ammoniac onto the molten babbitt and stirring it in.

In order to insure that none of the dross enters the bearing while it is being poured, six of the 20 railways use self-skimming ladles. These ladles have a bridge extending down inside from the lip, so that the babbitt metal is taken from near the bottom instead of from the top of the ladle. In pouring, the babbitt should run from the ladle in a steady stream directly down along the mandrel to avoid splashing or pocketing of air. If the metal is splashed against the mandrel, it will cause blowholes and give a mushy bearing. Ladles should be kept in proper repair, and the lips free from burrs or other irregularities in order that the babbitt metal may be poured in a smooth round stream.

It is almost universal practice to pour all bearings in a vertical position unless the shape of the bearings makes this position inadvisable, in which case the bearing is inclined at an angle most suitable and convenient for pouring. Split bearings are commonly poured by placing the two halves together in a babbitting jig and pouring the two halves at one operation. A few railways, among them the Chicago Rapid Transit Company, pour each half of the axle bearing separately, and in this case the parting face is usually placed down. Several railways have special jigs for their axle and journal bearings, so that the metal is poured into these with the bearings in a horizontal position. In babbitting armature bearings, the practice of the various railways visited appears to be about equally between pouring with the flanged end up and down.

More than half of the railways visited babbitt the ends of the flanges on armature bearings in order to provide for wear at this point. Where the end flanges are babbitted, it is quite convenient to pour these with the flanged ends up, since the thickness of the metal applied to compensate for end wear will vary considerably. Of the railways which do not babbitt the end flanges of axle bearings, four build these up by welding on additional bronze and remachining. The New York Central Railroad turns off the flange and then sweats on a new collar.

In babbitting journal bearings, it is universal practice to allow a small clearance at the edges so as to provide for the entrance of oil as the axle rotates. This clearance is commonly taken care of by the mandrels,

although in a couple of instances the railways scrape out a small quantity of the babbitt and round the edge.

In order to prevent babbitt metal from flowing out at the windows and at the edges, fireclay is frequently applied to the parts where there is excessive clearance with the babbitting jigs. After the bearings have been babbitted, the fins, burrs and excess babbitt are most commonly removed by using a hot iron. One railway reported that it filed and chipped off any excess babbitt, and another has a pneumatic tool for removing excess metal.

Some of the special practices used by various railways are of particular interest. Following are some points in babbitting practice followed on several of the railways. These illustrate how varying conditions influence the best methods to be used.

MILWAUKEE BABBITTING PRACTICE

From the pouring of the shell to the time the bearing goes into service on the motor, the details of its construction are under engineering supervision in the Milwaukee shops. Samples of the brass and babbitt compositions are subjected to chemical analysis in order to see that the standard is being maintained.

The bronze used for shells and linings consists of 85 per cent copper, 5 per cent tin, 5 per cent lead, and 5 per cent zinc. Fully six tons of this composition is poured a month for bearing purposes, of which approximately 50 per cent has been salvaged from wornout shells.

All babbitting of old and new brasses is done in a small room adjacent to the foundry. It contains the tinning pot, the babbitt pot and also the bench with three air-operated mandrel extractors. The new bearing shell is placed on the brickwork near the tinning pot to pre-heat it somewhat prior to tinning. As it has been previously rough turned both outside and inside, the proportions of the bearing not to receive tinning are coated with a solution of fireclay, applied by means of a brush. The bearing is then dipped into a tinning solution of 90 per cent tin and 10 per cent lead. This low quantity of lead has been used to prevent contamination of the babbitt with lead. If complete tinning has not been effected it is replaced in the tinning metal and the process repeated.

In addition to the anchorage offered by tinning, anchor grooves are cored into the shell to prevent the rotation of the babbitt lining. On a solid armature shell these grooves are made up in two parts, extending around the interior bore approximately ¾ in. from each end. Four longitudinal grooves connect with those which follow the contour of the shell, thus preventing the babbitt from turning or from sliding out of the end of the shell. While it is almost impossible to tin these grooves, the babbitt keys in to form an anchor. For split armature bearings the same style of grooving is used, but for journal bearings only longitudinal grooves are provided. These are somewhat heavier than those employed in armatures.

The mandrel used in Milwaukee, which is hollow, screws onto a piece of pipe fastened to the cylinder of the air-operated extracting device. A steel cover is held in place over the bearing window by means of a C clamp. With the mandrel and bearing in this position the babbitt is poured. Its temperature is held at 750 deg. F. as indicated by a pyrometer in the babbitt pot.

After the babbitt has set the mandrel is removed by means of an air-operated extractor. An adjustable hand clamp is placed over the top of the hollow mandrel and the C clamp is removed. When air is admitted to the cylinder, the piston is forced upward, causing a rod first to strike a plug which knocks out the window cover, and then to hit the cross-bar of the hand clamp, raising the finished bearing off the mandrel by means of the two tongs which engage the collar. Having a foot control this operation is accomplished very quickly. It is similar to that used in Cleveland, except that there the mandrels are pulled out instead of being pushed out, as in Milwaukee.

TABLE II—BOARD SHOWING PARTS USED FOR BABBITTING BEARINGS IN EAST NEW YORK SHOP OF BROOKLYN-MANHATTAN TRANSIT CORPORATION

Type Motor	BGS. End	BGS. Mtl.	Babbitting Tool Broach	Babbitting Tool Mandrel	Numbers Base
West. 81	C E	BZ	6	19	30
	P E	BZ	7	20	55
West. 93	C E	BZ	7	20	31
	P E	BZ	1	14	32
	C E		7	47	33
	P E		1	48	34
West. 101	C E	BZ	8	21	35
	P E	BZ	8	21	35
West. 49	C E	CI	8	49	36
	P E	CI	8	49	36
West. 68	P C		4	17	59
G. E. 57	C E	Mall. I	4	17	29
	P E	Mall. I	5	18	54
G. E. 64	C E	BZ	1	44	45
	P E	BZ	8	50	46
G. E. 80	C E	BZ	5	18	39
	P E	BZ	7	20	59
G. E. 234 A	C E	BZ	4	17	40
	P E	BZ	8	21	56
G. E. 800	C E	BZ	12	58	52
	P E	BZ	8	21	57
West. 50B	C E	BZ	13	26	43
	P E	BZ	13	26	43
West. 50E	C E	CI	1	14	27
	P E	CI	2	15	28
West. 50L	C E	CI	1	14	27
	P E	CI	3	16	53
West. 300	C E	CI	1	14	27
	P E	CI	3	16	53
Walker L 15	C E	BZ	9	22	37
	P E	BZ	10	23	38
G. E. 212 and 248	C E	BZ	12	25	41
	P E	BZ	8	21	42
	C E	BZ	1	14	60
	P E	BZ	2	15	61

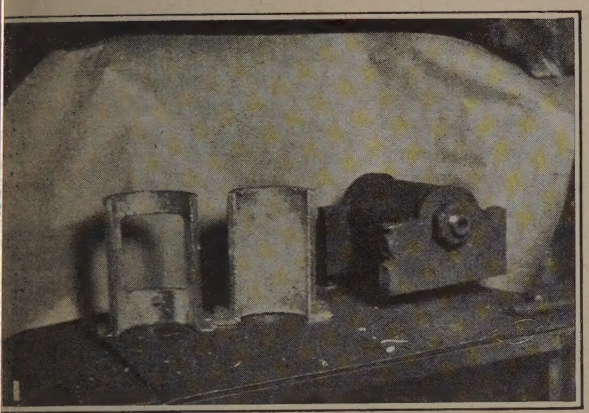
BABBITTING DEPARTMENT OF THE BROOKLYN-MANHATTAN TRANSIT CORPORATION

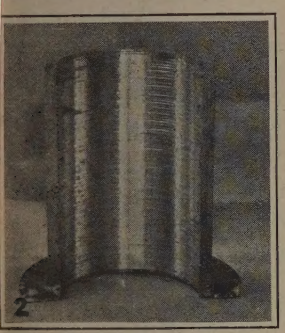
The Eastern Division repair shop of the Brooklyn-Manhattan Transit Corporation contains one of the most complete babbitting departments of any visited in this survey. Bearings are babbitted in this shop for all subway, elevated and surface cars of the system. The equipment consists of two babbitting furnaces and a tinning furnace, with semicircular benches for the workmen immediately in front. The semicircular bench is of particular benefit, since a man can reach all parts of it with very few steps from the furnace. Each babbitting furnace has two pots, one for armature bearings and the other containing a mixture with second-hand babbitt for axle bearings. As more armature bearings are turned out than axle bearings, workmen at both furnaces work on armature bearings regularly, and on journal bearings whenever opportunity presents.

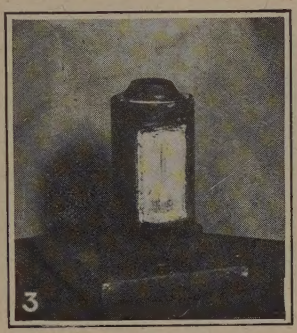
All babbitting pots are provided with recording pyrometers. Smoke charts are used. They are taken off at the end of each working day, 4:30 p.m., and then dipped in a thin solution of shellac to make the record permanent. New charts are put on the pyrometers each morning at 7 o'clock. When removed the charts are dated, signed with the initials of the foreman, and the number of the furnace and a record number also added. Genuine tin base babbitt is used in Brooklyn.

Each bench is provided with a box of snap gages. When bearings are received in the babbitting department they are gaged, and any over which the snap gages will pass are thrown aside for scrapping.

A carefully worked-out system for keeping track of ıbbitting jigs and mandrels is used in the babbitting ;partment. Each part is numbered and is placed in definite location on storage shelves. A large board :cupies one side of the babbitting department. On ıis is a tabulation in large numbers showing the varıs mandrels, bases and bands which should be used for ıch particular type of bearing, as shown herewith in able II. The columns give the type of motor; the ırticular type of bearing which is to be babbitted, such s commutator end or pinion end, the material which is sed for the bearing shell; the numbers of the various roaches used; the numbers for mandrels, and the umbers of bases. Thus, if a commutator end bearing







Babbitt Bearings in Chicago Rapid Transit Company Shop

No. 1. Axle bearing shells are babbitted in especially constructed horizontal mandrels producing a surface which requires no finishing.

No. 2. The anchorage used in the bearings extends within ¼ in. of each end.

No. 3. A preheated mandrel is used for babbitting armature bearings.

for a Westinghouse No. 81 motor is to be babbitted, the workman uses mandrel No. 19 and base No. 30. This method reduces the number of the various parts and makes it easy for the workman.

Bearings are poured with the babbitting metal at a temperature of 860 deg. F. The pyrometer records which were in place showed a variation of from 800 to 900 deg. Whenever new babbitt is added to the pot, the temperature drops but it is quickly brought up to the required temperature of 860 deg.

All armature bearings are poured in a vertical position with the small end down. In pouring split bearings, the flange or collar end of the bearing is down. The end flanges of armature and axle bearings are babbitted to provide for wear. After pouring a bearing, the burrs at the edges of the mold and at the bearing windows are removed by hot irons. A large forcing press is located between the two babbitting furnaces which is used for the removal of mandrels after the bearings have cooled. Equipment for grinding out excess babbitt by means of wire brushes is also included as a part of the babbitting department's machine tools.

Omaha Uses Cast-Steel Housings

Babbitt-lined cast-steel shells are used entirely for axle bearings in Omaha, except where the diameter of the axle is so close to that of the bearing housing that there is not room for the babbitt-lined shell, in which cases ordinary bronze axle bearings are used. The minimum difference in diameter between the interior of the bearing housing and the axle which is considered sufficient to permit the use of babbitt-lined steel bearings is 1 in. Since the practice is to use from $\frac{5}{8}$ to $\frac{1}{4}$ in. of babbitt in such bearings, the minimum amount of babbitt allows $\frac{5}{8}$ in. thickness for the cast-steel shell. If the clearance between the axle diameter and the bearing housing bore is less than this, the solid bronze type of bearing is used without babbitt. This is true of some types of motors in service, where it has been necessary to increase the axle diameter, so that there is insufficient room for the standard babbitt-lined steel bearings. Similar babbitt-lined steel bearings are used for armatures, except where the bronze bearing supplied with new motors are still in use. All journal bearings are babbitt-lined bronze.

Anchor holes are cast directly in the steel shells of axle bearings and a special groove is cut with a shaper longitudinally on the inside face. This also acts as an anchor to hold the babbitt in place. This groove is kept close to the edges on each half of the axle bearings. A special type of internal clamp is used to hold the two halves of the bearing together while they are being machined. Anchor holes are drilled in bronze bearings, consisting of 10 to 12 holes of about ½ in. diameter in each half, made as deep as practicable without allowing them to go through the shell.

Illinois Traction Practice

The practices in the manufacture and installation of bearings by the Illinois Traction, Inc., established some years ago, have resulted in an enviable record of no service failures from burned-out bearings due to the armature dropping upon the pole pieces. The finished bearing gives a life, with proper lubrication, of approximately 120,000 miles of service.

Following the customary method of tinning, the bearing is allowed to stand until the tin begins to solidify. This cooling of the bearing is considered an important factor in the successful pouring of babbitt and insures uniform cooling of the poured babbitt producing a homogeneous solid. If the babbitt cooled too slowly, the heavier ingredients would settle to the bottom of the lining.

A cast-iron mandrel is preheated to a temperature of approximately 300 deg. F., the temperature to which the bronze shell has been previously cooled, and then is placed in the center of the bronze shell. The mandrel is coated with a thin graphite solution to prevent blowholes in the babbitt.

As there is a foundry in the shop, it is possible to utilize scrap bronze shells in the manufacture of new ones. As high as 50 per cent of the composition is scrapped shells, while the remainder is of the following composition: copper 84 per cent, tin 12 per cent, zinc

3.5 per cent and lead 0.5 per cent. Most of the copper used in this composition is reclaimed from armature and field coils. This makes it necessary to deoxidize the composition and also eliminate to some extent the phosphorus present in the copper. A solution of muriatic acid and zinc chloride is used for this purpose, three ounces to 100 lb. of metal being the proper amount. Borings from the machine shop are also used. These are passed through a magnetic separator in order to eliminate the iron and steel, and then are placed directly into the furnaces. Often as much as 25 per cent of the composition is made up of borings.

The foundry has two coke furnaces with a capacity of 175 lb. each. The total amount of bronze poured per day amounts to 800 lb. This output includes bronze bearing shells, trolley wheels, and other small car parts.

Motor axle bearings are not babbitt lined, but are of the same composition as the armature bearing shell. These are cast in the foundry and are machined to the proper size. The company does not make its own journal bearings, purchasing standard M.C.B. brasses ready to insert in the box.

Chicago Rapid Transit Company Expects Bearing Life to Exceed Overhaul Period

On some divisions of the Chicago Rapid Transit Company's lines, the babbitt-lined armature and axle bearings of the motors have a life in excess of the mileage run between motor car overhaulings. While this practice was formerly the standard on the entire system, the company is now experimenting with a solid bronze bearing sleeve which has proved very successful on one division.

At the Metropolitan Division shops, the babbitting and rebabbitting processes are carried on in the conventional manner. In the case of armature bearings, the babbitt is poured around a steel mandrel, while the window in the shell is closed by means of a wood block. Axle bearings are originally of solid bronze and are babbitted only after the wear is in excess of $\frac{1}{8}$ in. A special mandrel of the exact size of the axle is used which holds the lining in a horizontal position while the babbitt is poured, and gives a $\frac{3}{32}$ in. thickness of babbitt around the inside bore and on the end-thrust collar. These bearings are rebabbitted until they fail mechanically. Some axle bearings used by this company do not lend themselves readily to rebabbitting and are therefore scrapped after they have received the initial wear.

In preparing either armature or axle bearing shells for babbitting a similar procedure is followed. With new armature bearings from manufacturers specializing in this work, the inside bore is given a rough cut to within $\frac{1}{4}$ in. of each end to provide an anchorage for the babbitt lining. The cut is made on a lathe with the feed set to give approximately four cuts to the inch. With the shoulders left at the ends and this rough spiral cut, the babbitt is held securely in place and no trouble has been had with loose babbitt. As a final test, before the bearing is placed in service, it is suspended and struck a light blow with a hammer. If it produces a clear ring like a bell the babbitt has a complete amalgamation with the shell; otherwise it is an indication that there is an air pocket or loose spot between the babbitt and the shell.

After the shell has been prepared by the anchorage cut, it is not necessary to recut the grooves throughout the useful life of the bearing.

With this type of bearing, records indicate that w proper oiling, a life of over 100,000 miles is obtair consistently. As this is the mileage which is used a basis for overhauling motor car equipment, there little necessity for having a bearing with greater li At the overhauling period, it is the practice to repla all bearings on the car and to fit each individual arm ture bearing to its shaft.

Denver Bearing Practice

The present practice of the Denver Tramway is machine all bearing shells both inside and out, althou formerly the castings were used in the rough stat Some babbitt lined cast iron shells are used for ax bearings on the older types of motors. For armatur babbitt lined bronze, solid bronze and babbit lined ca iron bearings are used. The cast iron shells are use only on some of the older types of motors, chiefly th GE 58. Journal bearings are all babbitt faced bronz

The amount of babbitt used varies with the size o the shell as only one standard arbor is used for castin the babbitt of each type of bearing. While a recordin pyrometer is not used in the babbitt pot, one will b installed when contemplated improvements in existin practices are carried out.

Babbitt is used on the end flanges of all babbitte armature and axle bearings. When solid bronze bear ings are worn through, they are babbitted and use over again. Because of the 42-in. track gage in Den ver, no axle collars are used as the motors occupy al the available space between the wheels.

Cast-iron bearing shells are cored out with six lugs which are $\frac{1}{16}$ in. over the armature shaft diameter Thus the babbitt thickness over the lugs is small enough so that there is no danger of the armature getting down on the pole pieces in the event of failure of the babbitt.

Nickel-Bronze Bearings Used in Youngstown

After exhaustive tests which extended over a two-year period, during which different formulas of babbitt metal and different methods of handling the rebabbitted shells were tried, the Youngstown Municipal Railway, Youngstown, Ohio, decided to equip all of its rolling stock with a good grade of solid nickel-bronze armature bearing without a babbitt lining. The treatment of the bearing shells previously used by this property is very interesting inasmuch as the company tried various means of procuring a satisfactory bearing before adopting the present standard. During the experiments iron, brass, and bronze shells were used with about equal success. When the shell was new, there was little difficulty in obtaining satisfactory bearings. However, the rebabbitting of shells presented the most serious problem, both from a physical and economical standpoint.

In preparing these shells for rebabbitting several methods were used. The shells were pickled in pickling vats for 48 hours to remove all grease and dirt; they were burned and baked in gas ovens, and some even were copper plated after they had undergone these preliminary treatments. Various types of anchorage were used to hold the babbitt in the shells. These included dovetailed grooves from end to end of the shell, holes drilled through the shells and countersunk on both sides and tinning of the inside of the shell with a formula of 75 per cent tin and 25 per cent lead. This later was reduced to 50 per cent tin and 50 per cent lead.

Equipment and Methods Used for Babbitting Bearings in the Shops of the Milwaukee Electric Railway & Light Company

No. 1. Armature brasses are coated with fire clay on portions which are not to be tinned. Grooves in the casting serve as an anchorage for the babbitt.

No. 2. Journal brasses have babbitt held in place by two longitudinal grooves.

No. 3. The babbitted bearing is removed by means of an air-operated mechanism. The tongs engage the flange of the bearings while the rod on the air cylinder provides the lifting power.

No. 4. Pouring brass in the foundry of the Milwaukee Electric Railway & Light Company.

No. 5. Axle bearing castings which represent a portion of six tons of the bearings poured per month in the shops of the Milwaukee Electric Railway & Light Company.

After being tinned the bearings were placed in various positions for pouring the babbitt. Mandrels were used, the bearings were poured solid, and some were even poured while the shell was being turned in a lathe at 3,600 r.p.m. In this latter process a special jig was set up in order to get a uniform thickness of babbitt without air holes. Various thicknesses of babbitt were tried inside the shells of the finished bearing, the thickness on the side wall at first having been $\frac{1}{8}$ in. which was later increased to $\frac{1}{2}$ in.

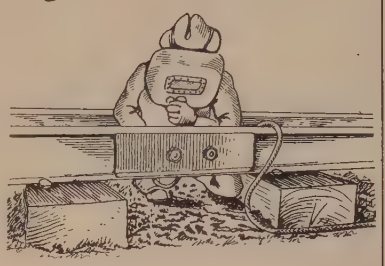
Precautions were taken to see that the motor housing was in the proper shape to receive the bearing. As another precaution, armature shafts were renewed or re-machined preparatory to running in the new bearings. Motors were run on a test rack at maximum speed for 10 minutes after which it was specified that the armature must be free to turn by hand. Even with these precautions, and under favorable conditions, a fair average for this type of bearing was found to be 48,000 miles although some ran 80,000 miles. This mileage is much less than that obtained from the babbitt-lined bearings received from the manufacturer on new motors.

However, the company was able almost to equal the mileage of new bearings by making new brass shells, lining them with new babbitt and placing them in a rebored motor housing with a new armature shaft. The cost of this procedure was prohibitive, and other means were sought to obtain bearings that would give long life. While these tests were going on, it was found that no matter what precautions were taken to remove oil and grease from the shells, still it would show up when the shells were preheated preparatory to rebabbitting. This grease would prevent the babbitt from adhering to all the surface of the shell, and an air space or bad contact between the shell and babbitt was formed. Such a space kept the heat generated in the bearing from passing off through the shell. At such spots the bearings showed heat and the babbitt started to melt.

Following these tests, it was decided gradually to equip all of the motors with bearings of the best grade of nickel-bronze obtainable. The rough bearings are purchased from a manufacturer in Pittsburgh. They are obtained with an excess amount of stock to be bored out of the inside. It is the practice to machine at least $\frac{3}{4}$ in. from the inside of all bearings and $\frac{3}{16}$ in. from the outside, allowing 0.015 in. clearance for a shaft of approximately 3 in. diameter and 0.022 to 0.025 in. clearance for an armature shaft of approximately 4 in. diameter. As a part of this installation, the armature shafts are turned or renewed in order to provide a perfect bearing. An end slug allowance of $\frac{1}{32}$ in. is given all motors. The motor housings are rebored and the bearing is made 0.001 in. larger than the hole in the motor housing per inch of diameter, to provide a pressing fit.

These nickel-bronze bearings have run as high as 175,000 miles, while a good average for those in service is around 157,000 miles. Due to its longer life, the bearing does not require as close inspection as one lined with babbitt, does not need as much lubrication after it has been in service for a short while, and has been found particularly valuable for reboring purposes after it has been used. When a bearing is worn too large for a particular shaft it may be rebored to fit one a little larger. This rebored bearing has the advantage over a new bearing that it is soaked with oil and does not require the careful attention that a new bearing does.

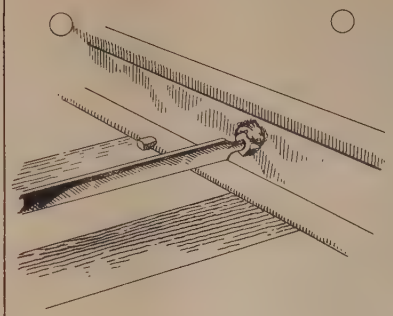
Of the motor equipment, 75 per cent is now provided with this type of nickel-bronze bearing. It is hoped that all of the company's motors will be changed over by the end of this year. The company has been several years in making this change, but it is felt that the results obtained from the new nickel-bronze bearings more than repay for the trouble and inconvenience that have been incurred. In all that time it has operated some 17,000,000 miles on this type without a hot armature bearing. The same type of bearing is also used for axles.



WELDING JOINTS IN SPECIAL WORK AND STRAIGHT TRACK

Material	acct 5 / acct 507
Labor and Hauling	acct 8 / acct 510

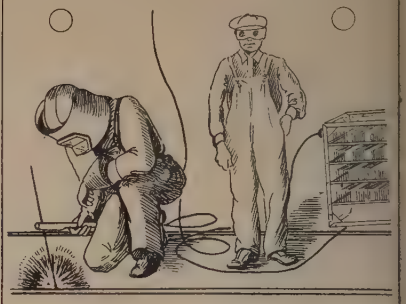
1



WELDING THE RODS

Material	a/c 5 / a/c 507
Labor and Hauling	a/c 8 / a/c 510

2



WELDING – Filling in Cups in Rails

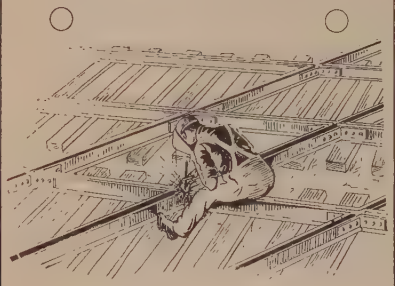
Straight Track

This is for repair to Rails — not joints.

For Joints see Picture 1.

Material	acct 4
Labor and Hauling	acct 8

3



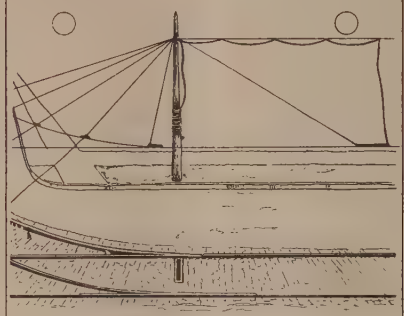
WELDING – Filling in cups in Rails
Special Work

This is for repairs to rails in Special Work – not Joints.

For Joints in Special Work see Picture 1.

Material	Acct.6
Labor and Hauling	Acct.8

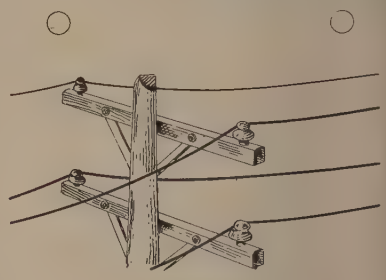
4



ELECTRIC TRACK SWITCHES
and
WIRING FOR SAME

Material	acct 6 / acct 508
Labor & Hauling	acct 8 / acct 510

105



HIGH TENSION POLE LINE.

Everything included – poles – anchors High Tension Wires.

Includes High Tension Pole Line from Trombly Substation to Mt. Elliott and Trombly.

Does not include pole line from Mt. Elliott and Trombly to Leesville Substation. For this see Picture 111.

Material & Labor	Acct 49 / Acct 544

110

TRIMMING TREES

To clear railway cars or feeders

Tools and Material	acct 9 / acct 512
Labor and Hauling	acct 8 / acct 510

To clear high tension lines

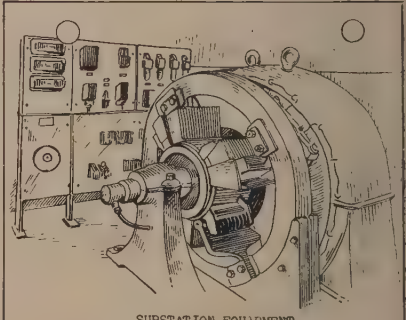
Tools and Material) Labor and Hauling)	acct 49 / acct 544

123

EFFICIENCY WORK BY LINEMEN

Broken and leaning poles and fixtures	Acct 20
Feeders, pos. & neg. o.h.	Acct 22A
Feeders, pos. & neg. undergrd	Acct 22B
Trolley and span wires	Acct 22D
Fires–derailed cars, vehicles on tracks	Acct 78

124



SUBSTATION EQUIPMENT

M.G. Sets – High Tension Apparatus – Switch Boards, Wiring

(except lights)

For Light Wires See Pictures 402 & 403

Material and Labor	Acct 48 / Acct 543

302

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Typical Sheets from Pocket Guide for the Classification of Electric Railway Accounts Used by Detroit Department of Street Railways

Correct Account Numbers Put on Jobs

By Means of Pictorial Instructions Foremen in Detroit Are Told How to Enter Correct Account Numbers on Their Work Sheets

THE adoption of the Interstate Commerce Commission's "Classification of Accounts for the Use of Electric Railways" was a great step forward, but its value necessarily depends on the care with which charges arising in practice are allocated to the proper account numbers. This in turn is affected by the knowledge of the accounts by the person or persons making the charges against the various accounts. In some of the major operations the correct account number is obvious, while in others, more especially in many of the minor operations, the reverse is true. If the account numbers assigned by the person with whom the charges originate are incorrect, the error will probably be carried right through the entire bookkeeping transaction.

Some people may say errors of this type are immaterial as long as the totals are correct and a reasonable allocation of charges by accounts is available for comparison purposes. This may be true, depending upon the mental attitude of the person by whom or for whom the accounting is being done. On the other hand, there is another factor in the situation, viz., the nuisance value because of differences of opinion over the proper accounts to which to assign charges for certain work. These differences may arise between foremen and timekeepers, timekeepers and superintendents, clerks and superintendents, etc., and generally relate to the most trivial subjects. It is obvious that any scheme which will reduce or, better still, entirely eliminate such differences is greatly to be desired.

It must be remembered that much of the work of allocation of charges for maintenance and construction work (except where timekeepers are employed for that particular purpose, which is not generally the case unless a large construction job is involved) is done by the men in the field who have personally done the work or else by their immediate superiors. It must also be remembered that the standard classification of accounts has five sub-classifications, each containing many divisions, the operating expenses alone comprising one hundred accounts. Some of the definitions of these accounts are quite extended. There are also printed in the last edition of the classification 440 questions and answers further defining and modifying the various charges to be entered under the account numbers.

To the accountant and to the engineer this volume of 250 pages is a problem in itself. What must it be to the foreman or timekeeper not specifically trained in its use? The accountant uses it from cover to cover, the engineer portions of it and the foreman and timekeeper limited portions. The foreman and timekeeper are in intimate contact with the field work, the engineer is in partial contact and the accountant only to a limited extent. In other words, those in closest contact with the work (where the major share of the charges originate) know the least about accounting. The field man is not apt to be equally proficient in the work to be done and in the method of accounting for it. His natural tendency is to memorize only a few account numbers and use these account numbers on his time sheet and material requisitions, rather than to consult the classification for the exact account number especially for minor items. At least, this is found to be the experience of the Department of Street Railways in Detroit.

To overcome this difficulty, H. M. Gould, electrical engineer (now acting assistant manager of the department), has prepared for the use of the electrical department's foremen a pictorial pocket guide (compiled after a thorough canvas had been made of all the possible types of work to be done, due regard being given to the various accounts and the 440 questions and answers) showing the correct account number to use in making charges. The sheets are divided into groups as follows:

Pages 1 to 100—Welding and Bonding.
Pages 101 to 200—Overhead and Underground Construction.
Pages 201 to 300—Power Stations.
Pages 301 to 400—Substations.
Pages 401 to 500—Light, Wiring and Telephone.
Pages 501 to 600—Laboratory.
Pages 601 to 700—General.

It has not been found necessary yet to provide this total number of sheets. At present the book altogether contains about 135 sheets, and gaps are left in the serial numbers for additional sheets as they may be found desirable. Reproductions of a few typical sheets, considerably reduced in size, accompany this article. The size of the pages in the book itself are 4 in. x 7 in.

To use the book it is only necessary for the man making the allocation to glance through the illustrations in the department to which the work belongs, it being well known that the people who will make use of a pictorial representation of facts have an inherent aversion to wading through a mass of text portraying the same facts. He will then quickly find the correct account numbers. Where there are two account numbers on a sheet, divided by a line, as with a fraction, as shown on several of the sheets, the user of the book is instructed to employ the upper number if the job is one of maintenance and the lower number if it is one of construction.

Provision is also made for the use of a manufacturing account (No. 411 in the classification) to cover such work as is done on supplies before they are charged out of stores.

Copies of this book, in blueprint form, are supplied to the superintendents of power stations, substations, lines and welding and bonding, also to the chief chemist, and electrical engineer. In addition to these copies the sheets showing the more common charges in each department are posted on the wall in a number of buildings where those most interested will be likely to see them. Later it is the intention to supply each field foreman with as many copies as he requires.

One-Man Operation in Arnhem

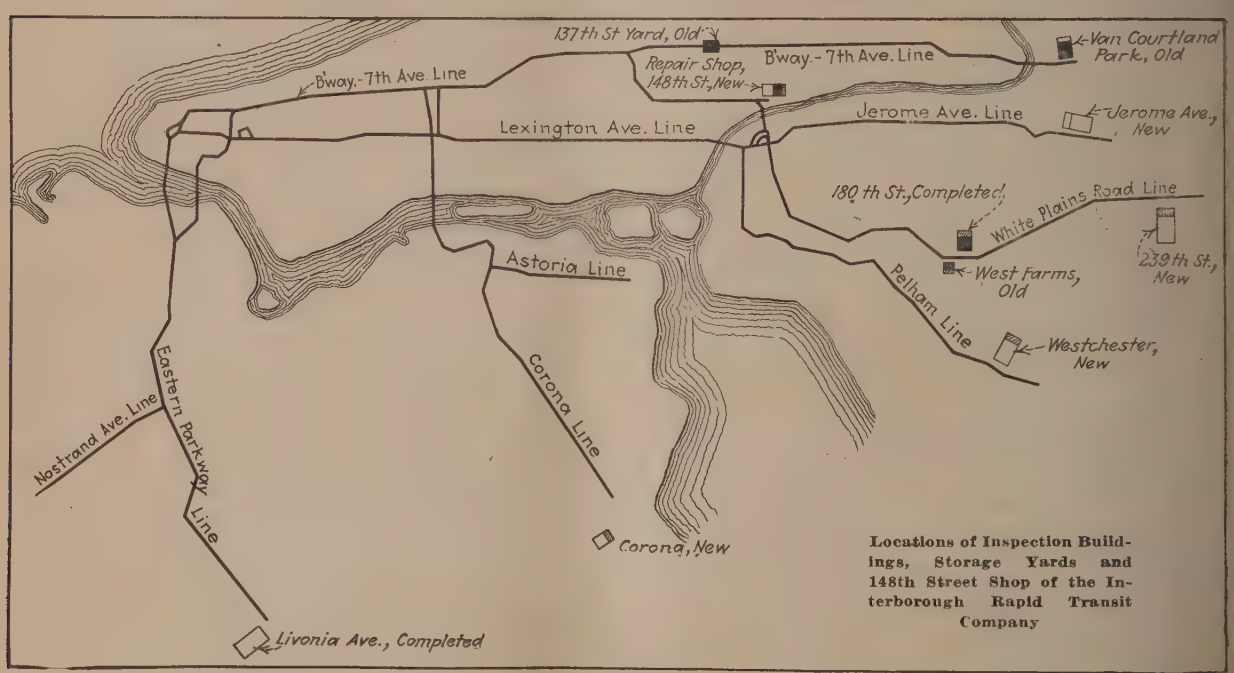
ONE of the leaders in one-man-car operation in Europe is the Arnhem Municipal Tramway System in Holland, on which several one-man cars were put in operation about 2½ years ago, after the manager of the system, P. M. Nieuwenhuis, had personally studied one-man operation in the United States. An account of the installation by Mr. Nieuwenhuis was published in the ELECTRIC RAILWAY JOURNAL for Dec. 2, 1922, page 881. The success of these cars has been so great that the entire system in Arnhem has been converted to one-man operation.

Interborough Inspection Shop Methods

Inspection of Elevated and Subway Cars on the Interborough Rapid Transit Railway Is on the Basis of 1,000 Miles for Motor Cars and 1,200 Miles for Trail Cars—The Work Is Thoroughly Planned — A Bonus Is Paid to Finders of Trouble of Vital Importance

WORK has recently been completed on a new inspection shed of the Interborough Rapid Transit Company at 180th Street. This is part of an extended plan for expanding the inspection and repair facilities of the company. There are now six inspection sheds of the company at which the work of making running repairs on the cars of the company is being conducted as follows: Bronx, 180th Street (completed); Bronx, Van Cortlandt Park (old shop); Bronx, West Farms (old shop); Bronx, Jerome Avenue (temporary); Brooklyn, Livonia Avenue (completed); Queens, Corona (temporary).

In additional, two other inspection sheds will be built as follows: Bronx, 239th Street; Bronx, Westchester.



Locations of Inspection Buildings, Storage Yards and 148th Street Shop of the Interborough Rapid Transit Company

This article will give an account of the methods followed in these inspection sheds. A later article will describe the shed recently completed at 180th Street.

Each day the mileage clerk makes out a list, giving the numbers of the cars that are due for inspection, with the number of trips or mileage that each of the individual cars on the list has made since the date of its last inspection. A careful record is kept of the mileage made each day by each car, and motor cars are inspected every 1,000 miles and trail cars every 1,200 miles. After the mileage clerk makes out his list of cars to be inspected, one copy is sent to the shop department and another copy to the train dispatcher.

As soon as a car is put in the inspection shed for inspection and repairs, the car checker compares the car numbers with his inspection list and puts a white inspection or work card on each car that is due for regular inspection. The front of the card so used is reproduced on page 240. The back of the card contains space for record of the inspection of the storage batteries, as each car on the system carries a battery for emergency lighting. There are 26 cells, and the gravity, height of electrolyte, volts per cell, and total volts are recorded. The fact that the inspection card carries a list of the jobs to be done relieves the individual workman from a great deal of bookkeeping, because he has simply to make his entries on this card. On roads of the size of the Interborough where several hundred men are employed on inspection and repair, it is considered very essential that each individual should be held directly responsible for the work he performs. This the work card illustrated allows, because it has listed all of the various parts of the equipment with space for the signature of the man who does the work.

No car is allowed to leave the pit until all items have been signed up. There are two other cards somewhat similar to the inspection card, as will be described later. One is blue and the other is red. This distinguishes them from the general inspection card reproduced in the first illustration because it is white.

BLUE AND RED INSPECTION CARDS

The blue inspection card is attached to those cars in a train in the inspection shed which are not due

Rack for Testing Control and Bus Line Jumpers at 180th Street Inspection Shed

for inspection, not having completed the mileage of 1,000 for motor cars and 1,200 for trail cars between inspections. Nevertheless, while these cars are in the shops, the company does give the more important parts, such as running gears, air brakes, draft rigging, and contact shoe devices a thorough inspection, and the parts of lesser importance a superficial inspection. The men sign up this card for work done in the same manner as with the white inspection card.

The other inspection card used is printed on red stock. It is used for regular inspection in the same way as the white card illustrated, but its color indicates that axle boxes, journals, etc., on the car are due for general oiling in addition to the inspection required on the rest of the car. The general oiling period is 0,000 miles. The entries on this card are printed somewhat closer together to allow for blanks covering the lubrication attention required. A separate entry n this card is made for motorman valves, feed valves, rmature bearings, air compressors, center plates, riple valves, journal bearings, axle bearings and gears, nd draft brake rigging and side bearings.

When all of the various classes of workmen have ompleted their work on a train and have properly igned the inspection cards, the train is pumped up, air rakes are tested, and brake rigging is adjusted, etc. he control and the motor circuits are then thoroughly ested. The train is then ready to return to service.

Other Blanks and Forms Used

Space will not permit a reproduction of all the arious blanks used, but one other is shown on page 40 and a brief reference will be made to the other ore important forms. The one reproduced is that used for lamp and fuse renewals, cars cleaned, etc. Some of the other blanks used during this inspection work include the following:

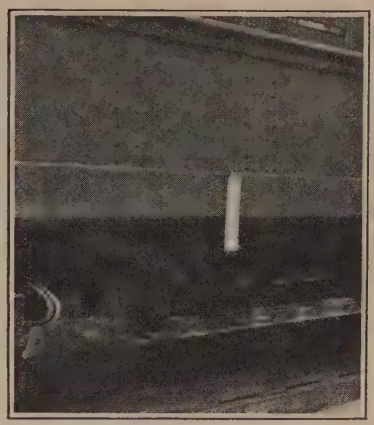
Report of broken glass replaced on cars.

Report of repairs made and defects found on the cars while in for inspection.

Report of journal brasses removed.

Report showing length of time the train was in the inspection shed.

Report of the cars inspected and mileage made since the last inspection.



As the Train Enters the Building a Clerk Places a Colored Tag on Each Car Indicating Kind of Inspection Needed

After these reports are filled out in the inspection shed, they are sent to the assistant to the general manager weekly. They are then tabulated and graphs are plotted showing the recurrences of different troubles, life of parts, etc.

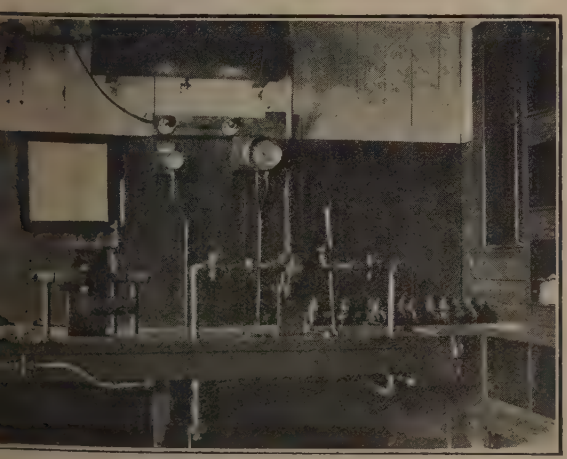
Division of Inspection Force and Layout of Gangs

Outlines of the duties of the inspection force and of the work performed are given in the two lists, printed on pages 241 and 242.

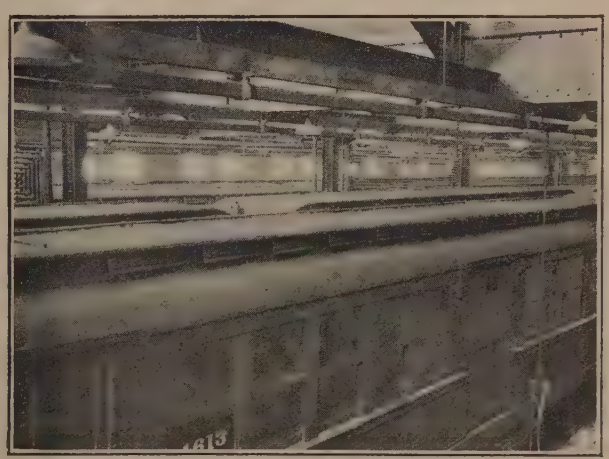
At the 180th Street inspection shed as many as 144 cars per day are inspected and for this work nearly 250 men are employed. These men work one shift of nine hours, some coming on duty at six in the morning and others at seven. A cleaning force and two emergency men are on duty during the night.

Although the work of changing wheels is usually done only at the main repair shops at 148th Street, some of this work is done at the inspection sheds when it seems desirable.

The storeroom at the inspection sheds carries a very complete supply of replacement parts, but only a week's supply normally is kept on hand as the supply car makes a trip to the various locations every day. The oil sup-



Rack for Testing Various Brake Valves, Feed Valves and Other Pneumatic Equipment



Power for Moving Trains Is Taken from an Overhead Conductor Through Flexible Leads

ply is cared for in a little different manner. The company has an arrangement with the oil companies whereby an oil tank truck delivers the supply direct to the inspection buildings. Storage tanks capable of holding two weeks' supply of the various oils used are to be found in the oil room.

FOLLOWING UP THE WORK

The work performed at the inspection shed is constantly being followed by a corps of special inspectors. These men drop into the various inspection sheds at unexpected times and check up the work and methods being employed. They report their findings directly to the assistant to the general manager.

The work of inspection is also greatly helped by information received from the transportation department. This comes principally from the motorman's report book. The entries in this book are filled out by the motorman and conductor for every car that has trouble on the road. This report gives the number of the car, minutes delayed, time taken out of service, nature of trouble, names of conductor and motorman, etc. Two books of this kind are kept at each of the terminals, these books being used on alternate days. This permits one book to be sent each day to the shop foreman. The clerk makes a copy of the book each day and returns it to the terminal so that it will be available for the following day. In addition to the entries made by the trainmen, this book contains a space in which the shopman making the repairs enters the nature of the trouble actually found and the repairs made. Space is also provided for his signatu

In addition to the methods described for detecti trouble, the company follows the unusual plan of p ing bonuses to employees for discovering vital defec This bonus is paid to any employee, regardless of classification or his rate of pay, who discovers a reports cracked or broken parts of the running ge of any car. This system of stimulating the detecti of defects to the vital parts of the equipment kee the men keyed up and is considered by the company t

INTERBOROUGH RAPID TRANSIT COMPANY

CAR EQUIPMENT DEPT.

_____ DIVISION

_____ TH STREET BARN, _____ 192____

MR. J. A. McCARTNEY,
Asst. Supt. Car Equipment.

INSPECTION AND REPAIR REPORT

CAR WINDOWS CLEANED				CAR SHADES AND BLINDS CLEANED	CAR SEATS AND BACKS CLEANED	CAR FLOORS MOPPED	COMMS. SANDPAPERED	HAND STRAPS CLEANED (CARS)	FUSES REPLACED IN SUPPLY BOXES			
1st TIME	2nd TIME	3rd TIME	TOTAL						4	2	20	MAIN

FUSES REPLACED											
AMPS.	1	3	4	10 OR 12	14	20 OR 25	100	625 SHOE	625 SHOE	MAIN	BUS.
BLOWN											
MISSING											

LAMPS REPLACED IN CARS				LAMPS REPLACED IN SHOP	TOTAL LAMPS REPLACED	CAR LAMPS LOOSE	MARKER AND HEADLIGHT FAILURES			
							LAMPS			
BURNT OUT	BROKEN	MISSING	TOTAL				BURNT OUT	BROKEN	LOOSE	

CONTACT SHOES REPLACED		TOTAL
WORN	BROKEN	

MOTOR CARBONS REPLACED			
MOTOR			TOTALS
WORN			
BROKEN			

_____ FOREMAN

INSPECTION AND REPAIR CARD

Car..... Barn.....

Date.....

Contractors, Reversers, Line Switch, Main and Bus Fuses, Rheos

Wheels, Wheel Flanges, Axles, Truck Transoms, Swing Hang Equalizer Bars, King Pins, Center Plates and Bolts, Draw Bars

Insp. by.....

Rep. by .....

Controllers and Switch Boards	
Motors Inspected Armatures Gauged	
Motors cleaned and repaired	
Jumpers and Sockets	
Light and Heat Circuits	
Clock Relay	
Contact Devices and Shoe Fuses	
Trip Devices and all Air Hose	
Brake Shoes Applied	
Trucks Inspected and Repaired	
Brakes and Trucks Inspected	
Air Compressor Inspected and Oiled	
Governor	
Drip Cups Cleaned	
Emergency Valves Tested	
Gear Pan Bolts	
Axle Box Bolts	
Main Reservoir Drained	
Platform Fittings	
Car Body Repairs	
Control Circuit Tested	
Brakes Tested and Adjusted	

LUBRICATION

Motorman's Valves	
Armature Bearings	
Triple Valve	
Draft Brake Rigging and Side Bearings	

Above, One of the Blanks Used by the Inspection Force. At Right, Inspection Card Which Must Be Signed by the Man Doing the Work.

In addition to the entries made by the trainmen, this book contains a space in which the shopman making the repairs enters the nature of the trouble actually found and the repairs made. Space is also provided for his signatu

In addition to the methods described for detecti trouble, the company follows the unusual plan of p ing bonuses to employees for discovering vital defec This bonus is paid to any employee, regardless of classification or his rate of pay, who discovers a reports cracked or broken parts of the running ge of any car. This system of stimulating the detecti of defects to the vital parts of the equipment kee the men keyed up and is considered by the company t best possible insurance against serious road troubl happening.

When this system of discovering defects is combine with the system described by which every man workin on a car personally signs the inspection card for eac part of the equipment he inspects and passes, assuranc is made doubly sure that all defects are discovered an the necessary repairs are made.

HEAVY REPAIR WORK

Heavy repair work is performed at the 148th Stree shop for the subway division and the shop at 98t Street and Third Avenue for the Manhattan divisio The former is shown in the map on page 238.

Inspection Routine on the Interborough

(These regulations are referred to on page 239)

Contactors. Inspect and change when necessary, all arc chutes, contactor bases, auxiliary fingers, finger blocks and auxiliary contact plates. These parts are to be kept cleaned and properly adjusted. The contactor base bolts and shunts are to be kept tight. Inspect all motor and bus rheostat leads and jumpers on rheostats. Clean the insulating collars on the circuit breaker and reverser. Remove the covers of the control rheostat coils and inspect and clean them. Inspect the main bus and power fuse and wiring. Arcing plates are to be removed when loose, cracked or broken, and are to be cleaned on all inspections. The clock circuit fuse and fuse block are to be cleaned on all inspections. All relays are to be cleaned and the leads must be examined for loose connections. P. K. commutating drums are to be cleaned off with a damp kerosene cloth, and the fingers are to be adjusted and lubricated on every inspection. The bus and control connection boxes are to be cleaned and inspected on a 10,000-mile basis. The circuit breaker arc chutes are to be cleaned and the inspectors should see that the tips make proper contact, that all parts work freely, that the head is on tight and that the line breaker trips properly.

Motor Inspection. Inspect armatures, commutator, brush-holder, brushes, etc.

Batteries. Remove all storage batteries (Edison type). Test each cell for voltage and specific gravity. Measure the height of the solution. Clean all cells and keep the top oiled. Use only distilled water when the solution is renewed. Clean the top of the cells with steam on a 60-day basis. Inspect the leads and see that they are properly insulated and that the connections are tight.

Jumpers. Change all train-line jumpers on a four-month schedule. Remove all jumpers that are in bad order or over the age limit. Clean out the coupler sockets and clean and spread and tighten all terminals in sockets and jumpers. Inspect the springs and covers on all sockets. See that all jumpers are properly inserted before the train leaves the barn.

Contact Shoe Device. Inspect and gage all contact shoes and beams. Remove the covers and examine the shoe fuses and leads on a 10,000-mile basis. Test out all shoe fuses on every inspection. See that all bolts in the contact devices are tight. Remove all shunts and jumpers where they are worn or broken. Remove all shoes when worn.

Compressors. Fill the crankcase with oil at the filling elbow. Fill the commutator oil well at the oil plug on the commutator side of the motor bearing. Do not oil on the crankcase side. Inspect and clean the inside of motor shell, fields, commutator and brush-holder and replace worn brushes, etc.

Governors and Relays. Inspect and adjust the magnet and air governor fingers and the battery charging switch.

Controllers. Remove the cover from the controller to inspect it. Remove the arc deflector. Inspect the main blow-out coil. Inspect and clean the fingerboard and flash shields. Remove the auxiliary fingers and block to inspect and clean contacts. See that all fingers are properly adjusted. Change all worn or burnt fingers. Clean the segments on the cylinders. Oil all bearing points on the cylinder and gear wheel. See that the screws in the controller top and water cap, controller handle and reverser cup are tight. Replace all weak or broken dog springs in the handle. Clean and adjust the fingers in the master electric-brake valve and engineer's valve. Inspect and repair all MS-41 and 10 switches. Install fuses where they are missing. See that all ⅜-in. pilot valve cut out cocks are sealed. Replace all worn parts.

Switchboards. Inspect and clean the switchboards and examine fuse clips, fuses, switches, etc., on each inspection, including the main switches. See that the proper rated fuses are in the circuits.

Light Circuits. Cut in the light switches on all cars and test all circuits and markers. Replace all missing and burnt-out lamps and broken sockets. Test out the emergency light circuit on all cars. Replace all missing and blown fuses on the switchboards.

Indication. Clean the indication boxes and disk on the pole contacts. Make necessary repairs on each inspection.

Clocks. Open the cabinets in all clocks (coasting recorders) and see that they are wound and supplied with tape. Test all clocks and circuit with a 4-volt battery. The clocks are to be changed once a year for general cleaning and repairs. Clean the clock relays on inspection.

Testing Indication. Test the motorman's indication circuit on all cars and in train formation. See that all trains are equipped with lamps, jumpers and plugs before they leave the barn. Replace any missing covers on the motorman's lamp boxes. Replace broken seals and rings in the signal box covers where they are missing or broken.

Air Brakes. Test the electric brake and control circuits from each controller and the brake valve in the train, using the electric brake key to determine whether the electric brake master switch is operating correctly and the electric brake fuse is in place. When the controller is in "on" position, let go of the button and make a test of the pilot and "E" valves. Pull all conductor's valve cords and test them for operation. Make a test of the compressors by cutting in all compressor switches. Test the balance circuit by cutting in one balance switch and noting if all the compressors are working. Note that the governors cut in at 85 lb. and out at 100 lb. pressure. Note that no leaks exist in the pipe system. Test the motor circuit on all cars by using a 5-lamp bank across main switch. See that all MS switches have fuses in and are left cut out. Examine the inspection tags and see that all work has been covered and signed for. No trains must be sent out until all work is completed, inspection tags signed, and car in good operating condition. Go around train and see that no men are at work on cars before the train is trolleyed out of the barn. Report all defects noted to the assistant general foreman.

Air - Brake Valve Changes. Change for cleaning at the repair shop, all UE-5 triple-vent A & T valves, governors, etc., on a one-year basis. Change for cleaning the compressors head on a 90-day basis. Make pipe repairs. Tighten pipe leaks, etc.

Car-Body Inspection. Inspect and repair all manually and air-operated doors, draft rigging, car body, interiors, platforms, fitting, etc. Replace all missing and empty Pyrene fire extinguishers. Repair the markers and headlights. Replace any broken glass and missing shades. Inspect the sanitary hand holds. Test all emergency cords, bell cords and bells. Inspect all destination signs and see that each car is fully equipped with these signs. Remove and replace all signs that are disfigured. The foreman of car-body inspectors will make a personal inspection of all cars passing through the barn.

Safety Gates. Inspect, clean and lubricate all gates and slides. Unhook and inspect all locks and springs. Open the gate and inspect for broken rivets in it. Inspect hand holds on all cars passing through barn.

Trip-Device and Air-Hose Inspection. Inspect, gage and adjust all trip devices. Inspect all hose on the car for chafing, being loose at the nipple, or over the age limit. See that all pipe clamps are in place and tight and that all bolts in the air-hose clamps are tight. Mark the height of the tripper on the inspection tag when it is signed.

Axle Box Inspection. Inspect and tighten all axle box and gear pan bolts. Remove and replace all broken axle brasses.

Oil Armatures. Inspect the waste and bearings on all motors passing through the barn for inspection. Remove all waste above the bearing and see that it is well lubricated. Remove all short and hard waste. Gage the oil on every inspection.

Journal Inspection. Inspect the waste and brasses on all cars passing through the barn. Remove the waste and brasses on the general oiling. Test the waste on all inspections.

Drip Cups. Remove all oil from all drip cups on all motors. Lubricate all brake rigging and drawbar slides.

UE-5 Valve. Clean the high-pressure portion of the UE-5 valve and clean the brake cylinder pressure limiting valve on a 30-day basis. Clean the 1-in. dirt collector on inspection. Fill the oil well. Examine No. 3 vent valve and the motorman's emergency cocks on inspection.

Reservoirs. Reservoir tanks are to be drained on every car going through the barn.

Air Doors. Test all air doors. Clean and lubricate all hand bases, sides, rods and gears. Remove all dirt from the door track. See that the door works at proper speed. Make all repairs, including any required on the locking device.

Feed Valves. Change the cab and control feed valves every 30 days. Oil the motorman's brake valve on inspection. Clean the ½-in. cab dirt collector on inspection.

Detailed Duties of Inspection Force on Interborough

The General Foreman is in full charge of the inspection barn and of all men assigned to the barn. He is responsible for the proper maintenance of the car equipment under his supervision. He also sees that full service at all times is available for the transportation department.

The Assistant General Foreman assists the general foreman and takes over his work when he is absent. The duties of the assistant general foreman are to run the floor, to check up on work of men, to see that trains are pulled out of the barn when turned over to transportation department, to inspect personally all cars that are cut out for the shop and all trains reported for trouble, and to see that all cars are properly tagged for the shop and are recorded in the log book. He also is responsible to see that the motorman's report book is checked, that the repairs called for in this book are made and that the book is signed to indicate that the repairs have been made.

The Assistant Carhouse Foreman's duty is to check up all cars reported by the transportation department as in bad order, also to check up the men working on the control circuits and to assist in making repairs.

The Clerks and Assistant Clerks keep the general records. They take care of all correspondence and see that the time cards are properly registered and the time recorded. On these and all other matters in which he is in doubt the chief clerk is to consult with the general foreman and assistant general foreman.

The Car Checker checks and tags all inspection and non-inspection cars. He also checks the bad-order list for bad-order cars and reports on the trouble to the assistant general barn foreman.

The Storeroom Tender receives and cares for all material and sees that there is an adequate supply of material on hand at all times.

The Motor Cleaners clean the retaining rings, brush-holder insulators, and the inside of the motor shell, fields and connections.

The Car-Body Foremen are in charge of the car-body and air-door device inspectors. They also keep a record of all repairs made by them on car bodies.

The Car-Cleaner Foreman supervises all car-cleaning work.

The Air-Brake Foreman is in charge of all air-brake and mechanical work, car body, brake and draft rigging, trucks, wheels, axle box, journal lubrication and packing.

The Air-Brake Inspectors inspect all work done by the brakemen and helpers on the inspection of cars. These inspectors also have charge of the general inspection of the "non-inspection" cars and give special attention to the toggle bar, brake pin, special lock washers and cotter keys.

The Electrical Inspector and Trouble Repairmen make the repairs to the electrical equipment and check the inspection of electrical apparatus.

The Motor Lead Inspector inspects the motor leads, ground leads, cleats, clamps, etc.

The Truck Inspector inspects all trucks for cracks on the side frame and in the transoms, equalizer bars, wheels, swing hangers, etc., for all cars going through barn.

The Wheel Inspector inspects all wheels, trucks, car body bolsters, king pins, drawbars and carriers, center casting and bolts, outside and inside equalizer bars.

The Wheel Inspector (Night) inspects all wheels, trucks, drawbars, shoe beams and general equipment. Every car in for the night must be so inspected. He also reports all defects which he discovers to the night barn foreman and leaves a written report for the general foreman.

The Valve-Room Men clean and test all feed valves, clean and grind the compressor heads, clean the compressor strainers and make minor air-valve repairs.

The Brakemen and Helpers inspect and renew brakeshoes, brake rigging, side bearings and truck chafing plates, pedestal and equalizer bars, etc., inside and out. New cotter keys must be used for all replacements. The key must fit tight in the brake pin.

The Car Inspectors will keep in touch with dispatchers and will report promptly when called by the train crews. They should keep a close check on the motorman's book and sign up when the repairs are made. They should immediately notify the general foreman when ordering a train out of service. In case of any train trouble or delay on the division to which the inspector is assigned he will give a detailed report of such trouble in the car inspector's book, which is provided for such reports. The car inspectors should see that all trains have markers when they leave the terminals. They should also make any necessary minor repairs to doors, signal circuits, markers and light circuits and control circuits.

The Lamp Trimmers equip all trains daily with refilled and clean tail lights. They should inspect the tail lamps on all trains each trip and should see that all lay-up trains are equipped with freshly trimmed lamps at both ends.

Trolleymen and foremen are the only ones allowed to apply the trolley to a train or to trolley a train out of the barn. The trolley is not to be applied to any car or train while men are working on it. Trolleyman will test brakes (electric and pneumatic) on all cars, but the brake adjustment is done by the air-brake inspector, as already described.

The Night Car Cleaners sweep and dust all cars and remove all newspapers from under seats.

The Day Car Cleaners carry out the following program: (1) Clean windows; (2) sponge seats and seat backs; (3) mop car floors; (4) clean and wash lamp shades; (5) wash sanitary hand holds; (6) wash white ceilings; (7) wash or wipe fan blades; (8) renovate the interior; (9) dry clean the interior; (10) clean the markers; (11) clean and dust under the seats, etc.

Peter Witt Car Rebuilt for One-Man Operation

Youngstown Company Has Converted Four of Thirteen Such Cars for One-Man Operation—Provision Has Been Made for Opening Side Door by Street Men at Heavy Loading Points

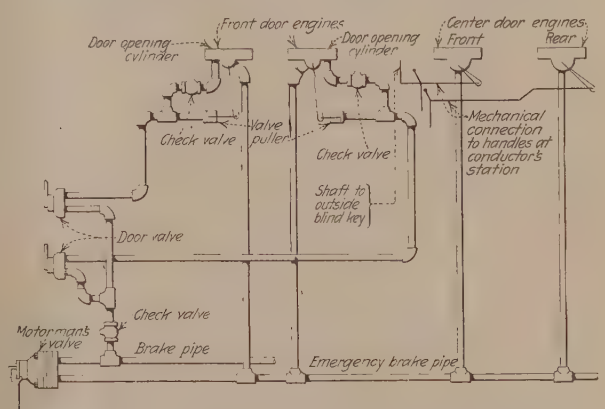
By A. B. CREELMAN
Master Mechanic, Youngstown Municipal Railway

IN ORDER that all of the rolling stock of the Youngstown Municipal Railway that is suitable might be operated by one man, 13 double-truck Peter-Witt type cars are being converted for this purpose. In making the changes necessary for safe one-man operation the company has not lost sight of the fact that the car may be needed for two-man operation during the rush hours and at some future time during the non-rush hours. Furthermore, it must be possible for these cars to be operated in trains with other cars equipped with GE emergency straight air brakes.

The fact that the converted cars are designed for single-end operation simplified the work of rebuilding. At the forward end the operating mechanism of the double folding doors was changed so that they could be operated independently as two single folding doors. These doors are air operated and controlled. They are interlocked with the air brake apparatus, and the H-L control is also interlocked with the doors so that power cannot be applied to the motors while any door is open.

Modifications of the company's standard practice were made necessary because it was not considered desirable to replace all of the air control and brake piping which was originally on the Peter Witt cars, as this piping was necessary when these cars were operated either to pull trailers or in multiple-unit trains. The modified layout of the door-operating mechanism is shown in the accompanying drawing. The GE emergency straight air brake equipment has the full pressure emergency air pipe, the door control being taken from the brake pipe line. A check valve was placed in the door control pipe just ahead of the control levers. A small bleeder pipe connects the door engine cylinder with the control pipe line at a point between the control lever and the puller valve on the engine. By introducing this by-pass and check valve in the control pipe the operator is forced to close the doors by means of his door valves, as the by-pass maintains the pressure within the control pipe, while the check valve in the control pipe prevents the escape of air to the air brake pipe. Without the check valve the door operating valve would be connected to the brake-pipe line, which is opened to atmosphere after the brakes are released. This would cause the doors to close automatically. However, at the next application of air the doors would be opened, if the door valves had not been closed. It is to eliminate this condition that the check has been introduced, while the bleeder pipe furnishes air to replace that lost through leaky control and check valves.

Another change from the standard layout of this company has been to take the door interlock contact off the door engine piston rod and place it directly on the door. Placing the interlock contacts directly on each of the four doors makes it impossible to start the car until the doors are actually closed. The necessary valves and reservoir were also installed to provide automatic sanding of the track when an emergency application of the brakes is made.

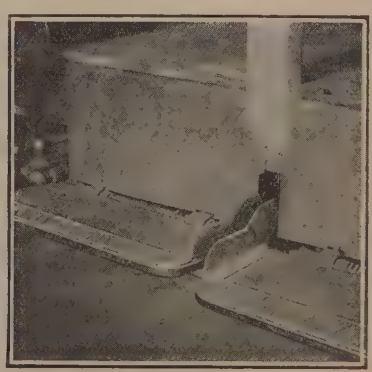


Modifications in Air Piping Give the Youngstown Car Full Safety Features, and at the Same Time Allow It to Be Operated in Multiple-Unit Trains Having G E Emergency Straight Air Brakes

The control of the two center door engines, which is mechanical, has not been changed, the two operating handles being mounted in the usual position near the side doors. When the car is operated by one man these handles are covered by a steel case which is locked in position, so as to prevent passengers opening the doors. During the two-man operation the box is removed. Air for the operation of the center doors formerly was taken

When Used as a One-Man Car the Center Side Door Control Handles Are Inclosed in a Locked Box to Prevent Passengers Opening the Door. When Operated by Two Men the Box Is Removed

The Side Doors of the Modified Youngstown Cars May Be Opened by a Street Supervisor by a Key Which Fits the Socket on the Side Exterior of the Car



Step Guards Have Been Provided at Adjacent Ends of Both Folding Steps at the Forward End of the Car to Prevent a Passenger Having His Foot Caught Between Them

directly from the main reservoir pipe. In order that the doors would be unlocked and could be opened by hand in case of an emergency application of the brakes, this arrangement was changed so that air is now taken from the emergency pipe.

DOORS CAN BE OPENED FROM THE OUTSIDE

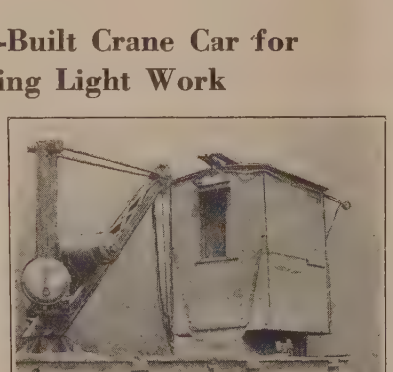
Means have been provided for opening the doors from the outside in order that the side doors may be used while loading in the downtown district during the evening rush hour. For this purpose a small ¼-in. square plug extends outside of the car. It is protected by a steel rim fastened to the side of the car. The plug forms the end of a rod which connects, by means of levers, with the control valve of the door-operating engines for the side doors. By means of a socket key, the street supervisor may control the door mechanism so that at the more congested loading points in the downtown district the supervisor can open or close these two doors from the outside. It is felt that this procedure will result in a considerable increase in the schedule speed.

As the car is operated by one man the double folding front doors are arranged to be opened individually. The forward one is for exit and the rear one for entrance, the passenger paying his fare as he leaves. A separate folding step is provided for each door. To prevent the departing passenger from getting his foot caught between the two steps a step guard has been fastened to the adjacent ends of both steps. These guards are of ⅛-in. steel approximately 10 in. long and 4 in. high, and are cut to such shape that they will slide back under the platform when the steps are folded up.

As a part of the rebuilding program the hot-air heating system has been replaced by thermostatically controlled electric heat. The cars have been repainted inside and outside and the four which have been rebuilt present a very neat appearance. The company has nine more of these cars which are to be rebuilt.

Cheaply-Built Crane Car for Doing Light Work

A HANDY crane car for doing the light work of the track department of the Massachusetts Northeastern Street Railway was recently built at the company's shops, Salem Depot, N. H., under the supervision of Harry Osgood, master mechanic. The underframe of an old flat car was reinforced by the addition of two extra 7-in. x 8-in. stringers. On the floor of the car was placed a base casting secured from a local foundry. The mast of the crane is a revolving 8-in. pipe passing through this casting and resting on an old truck center plate below the car floor. To this center plate has been riveted a larger plate which is suspended by four bolts from the base casting.



Home-Made Crane, Mounted on a Flat Car of the Massachusetts Northeastern Street Railway

The interior diameter of the base casting is 1¼ in. larger than that of the pipe, and ⅝-in. rollers have been inserted. This permits free rotation of the crane. The jib is built of 4-in. channel irons braced as shown in the accompanying illustration. At the top of the mast a casting has been shrunk in and cap screwed. Iron rods connect this casting and the end of the jib.

A Shepard 3,000-lb. electric hoist is used. In order to test the capacity of this crane car experiments were made which showed a maximum lifting capacity of more than 4 tons. When not in use the hook is fastened to the floor of the flat car to prevent rotation of the crane. Electrical connection for the hoist motor has been arranged by means of a controller finger.

The Readers' Forum

Careful Storage and Handling of Lubricants Are Important

THE TEXAS COMPANY

NEW YORK, N. Y., Aug. 5, 1924.

To the Editors:

I have read with considerable interest your articles in the July 19, 1924, issue of ELECTRIC RAILWAY JOURNAL under the headings "Putting Car Oil Lubrication on a Higher Level" and "Oil Storage and Handling Practice." I was particularly interested in the parts referring to improved conditions for storage and handling of lubricants.

When The Texas Company actively entered the field of selling petroleum products to the electric railways, one of the most flagrant and neglected important factors, as affecting efficient lubrication and the care of lubricants, was found to exist on the majority of properties in connection with the storage and distribution of lubricants. In line with our general policy, our engineers set about correcting such conditions on the properties where we secured the business, by furnishing up-to-date storage tanks with measuring pumps, locked faucets, modern electrically heated waste saturating outfits and other equipment necessary to place this important matter on a desired system, which resulted in vast economies, the elimination of fire hazards and greatly improved conditions as pertaining to lubrication as a whole. The use of sand, sawdust and other materials to soak up waste oils is not only wasteful but often these foreign matters get into the lubricant itself, which results in an inestimable amount of damage to bearings and shafts, which in turn causes greatly increased cost of maintenance.

After giving due consideration to furnishing nothing but high-grade, suitable lubricants, and to see that the same are properly stored and a record kept of each amount used daily, a fundamental factor necessary for the efficient lubrication of trolley cars, in which the major part of lubricants are used, is the proper saturation of waste. Practical experience has proved that each pound of waste should not contain more than 2½ pints of oil. When a greater amount is allowed to

remain in the waste, it is impossible to keep the waste properly against the bearings. A short time after bearings have been packed, where the feed of oil is by capillary attraction, the waste sags away from the bearings and trouble results.

In the article, you mention in particular: "That the quantities of various lubricants used are followed up very closely by representatives of the oil companies who visit the railway properties. . . ." This is quite true in so far as The Texas Company is concerned, and this detail is considered to the extent of seeing that no extravagance in the use of lubricants occurs, but not with a view of cutting the allowance of lubricants to a point where there is probability of trouble developing.

I also note that 23 railways which you have investigated are reclaiming lubricating oils, which are put to various purposes. Of this number only one road uses reclaimed oil in the same manner as new oil. This is the proper procedure, provided the reclaimed oil is thoroughly cleaned and of straight mineral character. All reclaimed oils can and should be used for the purpose for which the new oil was initially recommended. For other purposes proper lubricants should be furnished. This is the practical and profitable method to be employed and to compensate for the installation of reclaiming outfits.

It is a fact that oils which are properly filtered, having all foreign matter removed, have even greater lubricating values than unused oils. However, this is a matter to which those interested should give serious consideration and confer with those experienced in the physical characteristics, manufacture and application of lubricants. The general effect which lubricating oils undergo through use is principally to increase the viscosity.

Until such time as used oils have emulsified or become rancid, the lubricating value has a tendency to increase through passing off of volatile matter. It will be found that through long-continued use the viscosity may become too high for efficient results. Samples should be taken by the oil companies furnishing lubricants and advice given as to the proper blending with lighter oil, for the purpose of bringing the viscosity to normal again.

On the other hand, seven of the companies mentioned in the survey are using the reclaimed oils for various purposes in connection with truck parts. It is the writer's opinion that this is not at all economical, and as a whole the oils reclaimed are unsuitable for the purposes mentioned, and less expensive and more suitable lubricants could be used. Six of the companies use reclaimed oil for journal bearings. If the oil is properly reclaimed it should also be used for axle and armature bearing lubrication. Three of the companies use reclaimed oil in air compressors. If the oil used for the latter purpose is oil taken from the compressors and reclaimed, it is a practical move but not otherwise. Two companies use the reclaimed oil for lubricating shop tools.

It is a question of the suitability of the oil which has been reclaimed for this purpose, and in the previously mentioned uses of reclaimed oils the latter two companies should also see that the oil is properly cleaned and then used for the same purpose for which it was initially recommended. One railway uses reclaimed oil for freight cars, trolley bases, door engines, automobiles, for track and general oiling. In this instance the use of the reclaimed oils in freight cars is practicable, but for the other purposes mentioned it is quite out of line, and for several of the purposes entirely unsuitable.

Another important matter which must be considered is the use of seasonal grades of oils. These consist of heavy-bodied oils for summer use, in which the pour test is comparatively high, whereas the lighter bodied winter grades of car oils have a pour test at the zero point. The regulation of the use of reclaimed oils as affected by initial physical characteristics can readily be handled so that uniform products can always be at hand for use.

GEORGE R. ROWLAND,
Superintendent Electric Street Railway Sales.

Testing Hangers to Make Sure That Studs Do Not Pull Out

BROOKLYN, N. Y., July 7, 1924.

To the Editors:

The description of the testing laboratory conducted by the Department of Street Railways of Detroit, as published in the ELECTRIC RAILWAY JOURNAL of June 28, gives a method of testing trolley hangers to insure that the studs will not pull out of the insulation when the hanger is heated. A similar test has been used by the Brooklyn-Manhattan Transit Corporation and its predecessors, the Brooklyn Rapid Transit Company and the Transit Development Company, for at least ten years.

There is one marked difference in the requirements of the Detroit and Brooklyn specifications. The temperature required is really the same, 65 deg. C. in Detroit and 150 deg. F. in Brooklyn. The length of time at which the hanger is to remain at this temperature differs, however, in the two companies. In Detroit one hour is specified, while in Brooklyn it is but thirty minutes. A half hour should be long enough to allow the insulating composition to become thoroughly heated and softened and will lessen the time required for testing.

The great difference in the tests is in the pull applied to the stud. While the Detroit specification requires only 100 lb., in Brooklyn the hanger must withstand a stress of 2,000 lb. While 100 lb. is more than the weight of the wire and overhead fittings that the hanger will probably ever have to support, yet the greatest strain on the stud will come, not under normal conditions, but when the trolley pole of a car gets hooked into the wire. To withstand the pull which it then will receive, and yet have some factor of safety, the test of 2,000 lb. does not seem to the writer to be too much.

G. H. MCKELWAY,
Engineer of Distribution
Brooklyn-Manhattan Transit Corporation.

Diameter of Detroit Trolley Wheel

DEPARTMENT OF STREET RAILWAYS
DETROIT, MICH., Aug. 11, 1924.

To the Editors:

It has been called to our attention that in the article regarding trolley breaks in your issue of July 19, the outside diameter of our wheel was shown as 8§ in. This is incorrect, as the outside diameter as shown on the blueprint is 5§ in.

I would appreciate your calling attention to this error.

H. S. WILLIAMS,
Assistant Superintendent of Equipment.

Equipment Maintenance Notes

Steel Frame Relieves Strain on Car Body in Hoisting

AN INGENIOUS arrangement has been devised by H. B. Baldwin, master mechanic Bangor Railway & Electric Company, Bangor, Me., for use in hoisting car bodies in the shop. Almost the entire equipment of this railway consists of lightweight safety cars, and the usual method of raising car bodies in the shop is by means of a QMS crane and a Yale triplex block, as shown in the accompanying illustration. In order to relieve the strain on the car underframe, which would result from attaching the block directly to the bumper, a V-shaped steel framework is used. The two arms extend under the car platform and U-shaped pieces hook over the channels of the car underframe. At the point is a large iron ring to which the hook of the hoist is attached.

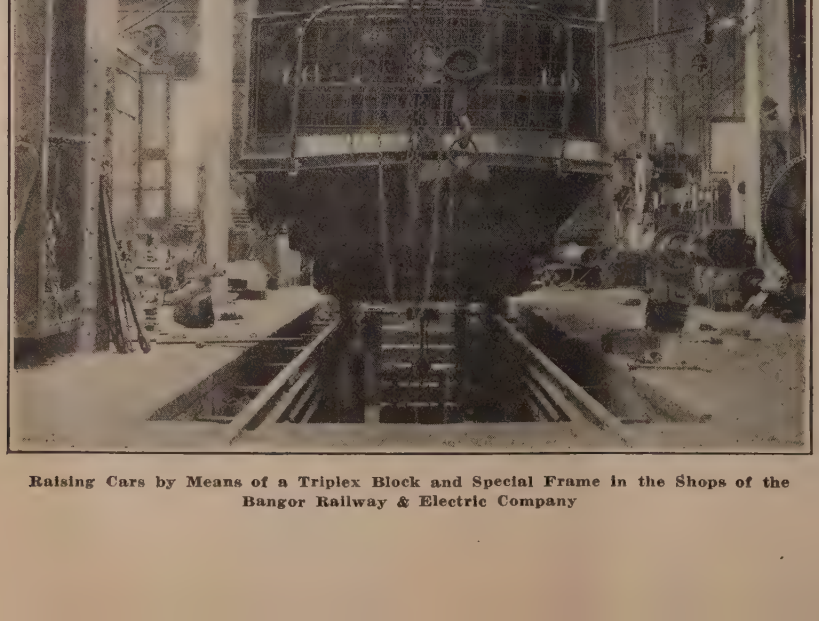
Frame Used to Take Strain from Car Body

Mounting Grid Resistors to Keep Them Cool

EXPERIENCE has shown that the location and mounting of grid resistors has considerable effect upon the temperature they attain while in service. Since the circulation of air through the grids provides ventilation, it is quite essential in keeping the resistors cool that the individual grids themselves be arranged lengthwise of the car, as the movement of the car then will cause a current of air to pass between the grids. Where it is necessary to mount these near to the wheels of a truck it is common practice to install splash guards to keep out wheel wash.

These splash guards shield the grids from air circulation as well as protect them from water, and precautions should be taken to make certain that they are not installed too close to the grids themselves and that as much space as posible is allowed for air circulation.

Another point that will assist in keeping the grid resistors cool is to drop them as low as possible underneath the car. This location is not only of advantage for ventilation but also gives more freedom for making the cable connections. In lowering resistors care should be taken not to mount them too close to the rail since there is danger of some high part striking and breaking the grids. A clearance of at least 10 in. is desirable between the top of the rail and the bottom of the grid resistors.



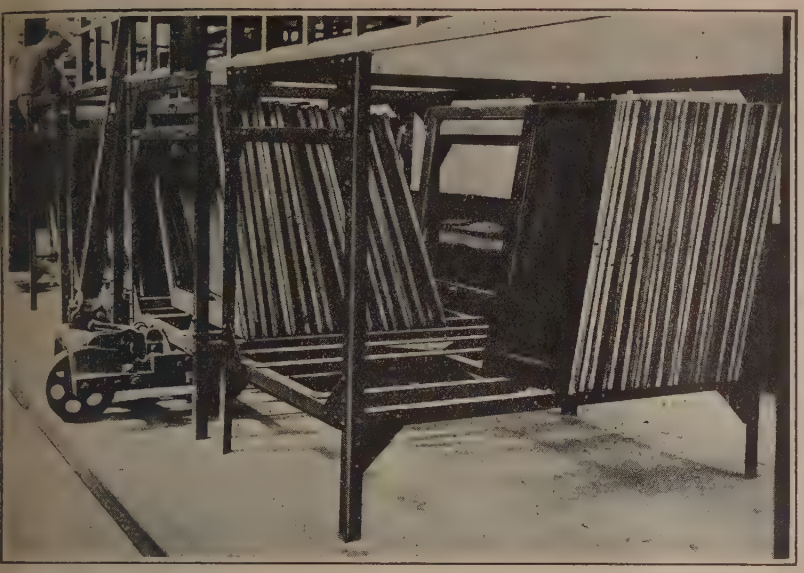
Raising Cars by Means of a Triplex Block and Special Frame in the Shops of the Bangor Railway & Electric Company

Convenient Racks for Handling Car Sash

RACKS for storing and transporting car sash have been found particularly useful for overhaul work in the shops of the Department of Street Railways, city of Detroit, as mentioned briefly in the issue of this paper for July 5.

These racks are made up of 1¼-in. x ⅛-in. angle framing, riveted together and braced at the corners by small gussets. The vertical members are carried down to form short legs and, as shown in the accompanying illustration, the horizontal top angle is omitted from one side to facilitate stacking and removing the sash. In the bottom framing two horizontal flat steel strips are placed to form a support for small upper sash as well as for the larger size lower sash. The racks are of sufficient size to take a full set of sash for a car.

Cowan lift trucks are used to



These Racks Are Used in the Detroit Shops to Carry Complete Sets of Car Sash

ransport the racks about the shops. They are run under the racks, as hown in the accompanying illustraion.

When a car is stripped for overauling all of the sash are stacked in ne rack. They are then transported n complete car sets to the cabinet hop, where any necessary repairs re made. After this work is comleted, the rack with its complete set f sash is transported to the paint hop. By using small wooden vedges between the upper edges of he sash they can be readily stacked irectly in the racks after being efinished and are then transported ack to the car from which they were aken. The use of racks of this type educes the amount of handling to a inimum and avoids broken glass nd other damage.

Simplifying Air Hose Assembly

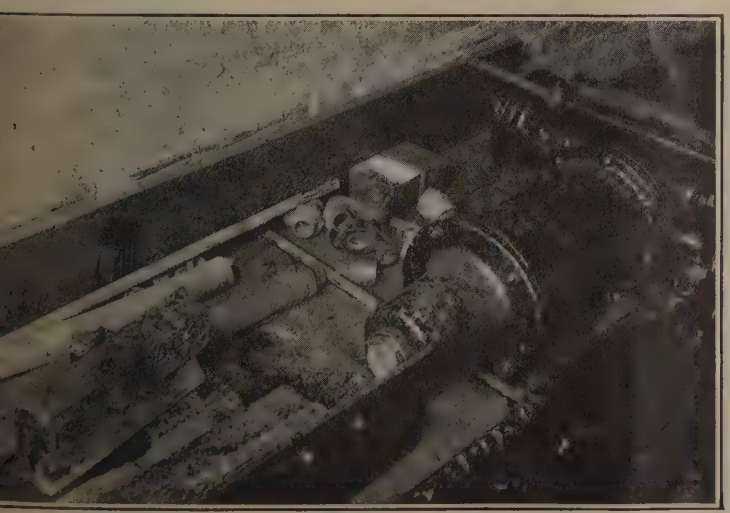
THE task of assembling air hose has been simplified in the shops of the Illinois Traction System at Decatur by applying fittings to each end of the hose and placing a band around to reinforce the connection. These operations are performed by pneumatic machines. One forces the fitting into the end of the hose, and another shrinks the clamp in position while the clamp bolt and nut are inserted.

The first apparatus consists of two parts. A holding device has a movable jaw 10 in. long grooved out to fit the hose, which is brought up against a similar stationary jaw. The movable jaw is actuated by air admitted to an 8-in. x 12-in. brake cylinder, the piston rod of which is connected to a toggle link mechanism. The movement of the piston closes the jaw while a spring returns the mechanism to its original position. Directly in line with the longitudinal hole formed by the closed jaws is another 8-in. x 12-in. brake cylinder with a blunt ram on the end of the piston rod. This is used for forcing the fitting into the hose while it is held in position by the jaws.

This apparatus is also used for removing fittings from old air hose. After the fitting clamp has been removed, the hose is clamped in position, a piece of small diameter pipe placed through the hose, and pressure applied to the end of the pipe by the cylinder used to press in fittings. The coupling fitting is removed first, then the hose is reversed, and, after a pipe cap has been screwed onto the threaded fitting, this fitting is removed.

After the fitting has been inserted, the hose is placed in the second apparatus. This consists of another 8-in. x 12-in. brake cylinder having a curved die, mounted on the end of the piston rod. When extended, this die meets a similarly-shaped concave anvil, curved to receive the hose. The binding clamp is placed in the proper position around the hose and the hose inserted between the jaws of the apparatus. Pressure is applied by admitting air to the cylinder, and with the clamp squeezed as tightly as possible the retaining bolt is inserted and the nut made tight.

With these two pieces of apparatus the shops are able to turn out 1,000 $1\frac{3}{8}$-in. standard A.R.A. complete air hose in three days. This work is



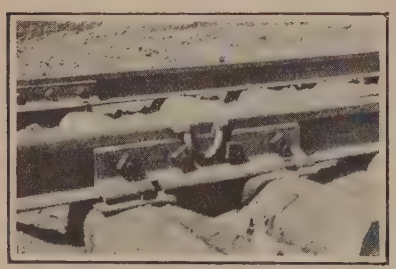
At Left, Brake Cylinder Used to Force Fittings into Air Hose. At Right, Jaws Hold Retaining Clamp Shut Until Nut Is Tightened Up on Fastening Bolt

done for the stores department, the complete hose being requisitioned when needed in the shops.

Dirt Track Foundation in Portland

ON SEVERAL recent track rebuilding jobs the Cumberland County Power & Light Company, Portland, Me., has successfully used the old dirt foundation underneath its ties. A usual type of construction of this railway embodies 6-in. 100-lb. T-rails, wood ties, and granite block paving. Where the track has been in service many years and the ground is firmly packed under the ties no ballast is used in reconstruction work. The old ties are allowed to remain in place and new rails laid directly on them. Elsewhere, when needed, rock ballast is used for the track foundation.

Track in Portland Paved with Granite Block Inserted Under Rail Head



No Ballast Is Used Under These Ties, Which Rest on a Dirt Foundation

Concrete is poured between the ties up to the approximate level of their tops. Granite blocks are inserted under the head of the rail. By carefully selecting the blocks to get the larger sizes in the center of the track, the pavement is given the necessary crown. This type of rail and pavement is extensively used in Portland and has proved entirely satisfactory not only to the railway, but also to other users of the street.

A Summons for Dick Prescott

And He Answers With Some Misgivings

FOR several days following Mr. Milburn's visit, there was a feeling in the shops of the Consolidated Railway & Light Company that important changes were imminent. Nobody, however, knew what to expect.

In the brief period since coming with the company as its general manager, Mr. Milburn had shown a firm hand in instituting various changes in the practices of several of the departments. His courteous manner, coupled with obviously wide experience and mature judgment, had made a very favorable impression on the various department heads, and he was well along toward receiving full co-operation from them.

Thomas Mullaney alone had held aloof. While called general foreman of the shop, he actually was the superintendent of equipment. Previous changes in management had had little effect on his department. Usually the general manager had been too busy with other things to pay much attention to the shop, and Mullaney had visited the head office only on rare occasions.

Mr. Milburn's unannounced visit was a wide departure from precedent. His manifest interest in the shop equipment and methods gave each foreman an unusual thrill of pleasure and importance. His declared intention to follow the department's activities closely caused general comment and speculation.

During the several days since this visit, Mullaney himself seemed changed. A long conference in his office had followed the trip through the plant, and since them Mullaney had put in much of his time in the shop. He had suddenly become critical of existing practices and seemed unusually interested in suggestions for improvements. His stock reply of "We tried that 15 years ago," or "This has been good enough for 20 years, why change it now?" was strangely absent when the various foremen mentioned possible improvements.

Steve White, carpenter foreman, was delighted with the new trend of events, but still he felt uneasy about his spirited conversation with Mullaney, part of which at least he felt had been overheard the day Mr. Milburn had appeared unexpectedly in the shop. But Mullaney said nothing further on the matter.

Meantime, Dick Prescott, in his capacity as carpenter's helper, was outside the circle of active discussion of impending events, except as the men in the ranks noted and commented on obviously changed conditions. Dick had rapidly made friends among the men with whom he came in contact, even including some of the foremen. He had taken his place as a carpenter's helper with a willingness and cheerfulness that impressed those about him. No task seemed too small to be done well, and no man seemed too lowly to receive a cheerful lift if Dick was near by. During the lunch hour he joined the various groups, and was soon sought after to join in sports of his associates or to give an opinion.

Steve White had taken a particular liking to Dick. So when, several mornings after Mr. Milburn's visit, a telephone call came to have Dick report at once to Mullaney, he conveyed the message with some misgiving. Such a summons to Mullaney's office in the morning had never, to Steve's knowledge, been the occasion for rejoicing.

Dick was helping old Bill Newman, the carpenter, lift a heavy corner post into place when Steve called him aside.

"The old man wants you in the office," said Steve.

"Wants me?"

"Yes, said he wanted you there right away."

"All right. Thanks, Mr. White," said Dick. "Then I guess I'd better start right over. Somebody will have to give Bill a hand," and he nodded in the direction of the old carpenter, who stood waiting. "Those posts are pretty heavy."

"Go ahead," replied Steve, "I'll take care of that."

Dick swung briskly off, anxious to make a good impression by being prompt. As he entered the outer office, the sullen-faced clerk at the timekeeper's window stared at him curiously.

"Mr. Mullaney sent for me," said Dick. "Is he busy now?"

"Knock on the door and you'll soon find out," was the ungracious reply.

Dick approached the heavy door to Mullaney's office and rapped firmly on the panel.

Electric Sand-Drying Apparatus Used by the Massachusetts Northeastern Street Railway

Electric Sand Dryer

A SIMPLE and convenient apparatus for drying out sand used on the cars of the Massachusetts Northeastern Street Railway has been designed by Harry Osgood, master mechanic, and installed at the company's shops, Salem Depot, N. H. A rectangular wood bin, about 2 ft. high, was built parallel to and between a pair of tracks in the carhouse. Near the top of this bin six old-fashioned electric car heaters were placed crosswise. Above them is a wide-mesh screen surrounded by 8-in. boards placed on edge. Wet sand is heaped on top of the screen, the heaters are turned on and as the sand dries it drops down into the bin. Trainmen desiring to secure sand for their cars obtain it through one of three sliding doors to the bin by means of a bucket and shovel.

Some Precautions in Rewinding Armatures

GREAT care should be used in rewinding armatures to guard against failure in service. Sharp corners and rough nicks in the slots which might damage the coils should be filed down. All chips and filings should be removed carefully before attempting to apply the insulating material to the coil. The coil itself should be a tight fit in the slot and should be wound so that its top is ⅛ in. above the band grooves. Fillers should be used between the top and bottom coils if necessary to get the correct position. By having the coils extend above the band grooves they will be pulled down tight when the bands are applied. The bands, however, should rest on the iron in order to prevent movement in service. If the coils are wound too high the bands will not rest on the iron, and when the insulation dries out in service the bands will become loose.

While placing the coils in the slot they should not be twisted or abused any more than is absolutely necessary. Care should also be taken to avoid crossing of the leads in such a manner that when pressure is applied there will be danger of a short circuit. The ends of coils should be forced down against the coil supports so as to make a solid foundation for the bands, but pounding should not be carried to the extent that the coils or leads are damaged. The tool used in driving the leads into place should be free from sharp corners that might nick the leads and result later in broken wires and open circuits.

Insulated protecting sleeves should be placed at all points where the coils cross and where there is danger of short circuits. The cotton sleeving used on the leads should not be allowed to get into the commutator slot, as it may prevent soldering.

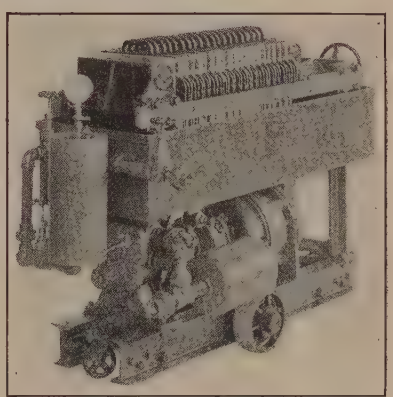
New Equipment Available

Improvement in Oil Filter Presses

AN IMPROVEMENT in the oil filter press manufactured by the General Electric Company is the addition of an air bell for testing suction piping so as to avoid freely mixing air with the oil as it is being purified. This is undesirable in most modern types of power transformers which are equipped with special tanks to keep the air out of solution in the oil, thereby greatly prolonging its life and assuring its efficient operation.

Leaky suction pipes and joints in pipe lines to the purifier have heretofore been one of the most difficult conditions to guard against. To facilitate precautions against such leaks all G-E oil filter presses are equipped with air bells which provide a simple and convenient means for testing the tightness of the suction piping, pump stuffing boxes, etc., before filtration is begun.

The air bell is so arranged that it can be pumped up to the shut-off pressure of the filter press pump. After the suction pipe valve is closed at the transformer drain the pump is stopped and the stored air pressure is automatically released against the oil in the suction piping. If this piping, the pump stuffing boxes, etc., are in good condition, it is possible to hold the pressure of 20 lb. or so for several hours, although 10 or 15 minutes will be sufficient to test, as any leaks will generally show up immediately. Leaks will now be outward and will show oil coming through so that they can be readily located and corrected. The actual pressures obtained during this test depend upon the relative volumes in the air bell and the suction piping, and hence will vary somewhat with the conditions of the installation. Air bells are available as supply material for equipping existing filter presses with this new feature.



Oil Dryer and Filter With Capacity of 25-30 Gallons per Minute

Electric Furnace for Heat Treatment

A NEW industrial hearth-type electric furnace for operation up to 1,850 degrees Fahrenheit has been recently perfected by the Westinghouse Electric and Manufacturing Company. These furnaces, known as type B, are made with hearth sizes ranging from 4 in. wide and 10¼ in. deep to 12 in. wide and 36 in. deep. They are suited for such operations as annealing, hardening, tempering, normalizing, carbonizing and case hardening. Automatic temperature control makes it possible to duplicate heating conditions and enables a predetermined manufacturing schedule to be carried out.

Electric Furnace with Control Pyrometer

A distinctive feature of this new furnace is that the muffle plates, which completely inclose the heating chamber, are perforated so that heat is radiated directly from the heating element to the charge. This unusual construction permits a high temperature in the heating chamber without undue deterioration of the heating elements. These elements, which are S-bend coils of nickel-chromium wire, are placed on all four sides of the heating chamber and are supported and aligned by molded studs on the muffle plates.

The door of the type B furnace is suspended by a chain from one point. The operating handle is counterweighted so that the door opens or closes easily and will remain in any position. Angles bolted to the guides hold the door closely against the front casting but allow it to move easily.

Standard insulating bricks next to the shell are supported by the high temperature insulation, which is in the form of slabs, relieving the muffles of the weight of the insulation. The furnace shell, or casing, is of heavy sheet steel, with the sides and bottom in one piece. The top, however, is a separate piece to facilitate removal for repairs to the insulation or heating element.

The rear casting design is a frame supporting an asbestos panel through which the ends of the heating coil protrude. Heavy air-cooled connectors join the coils in series and connect to the lines.

The automatic control of this furnace enables the operator to maintain a desired temperature indefinitely. In the control instrument, a stationary pointer carrying two electric contacts is set at the desired temperature and the furnace turned on by a conveniently located push button. As the temperature rises, an indicating hand moves along the scale. When it reaches the upper of the two contacts carried by the stationary pointer, the relay is energized, opening the magnetic contactors and cuts off the current. When the temperature falls to the point where the indicating hand reaches the lower of the contacts on the stationary pointer, the relay cuts the current on again. By this means the temperature may be kept within limits of approximately 1 per cent without any attention on the part of the operator.

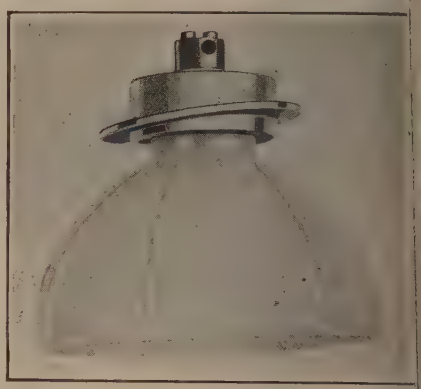
Red Lead-Graphite Primer

THE Joseph Dixon Crucible Company, Jersey City, N. J., has placed on the market another paint product known as Dixon's red lead-graphite primer, after tests lasting for over a year. The pigment of this primer consists of flake silica-graphite, red lead and high grade oxide of iron. The vehicle is boiled linseed oil. The primer will dry perfectly in 22 hours under normal conditions and will cover approximately 400 sq. ft. to the gallon on metal surfaces.

The new primer is said to have qualities of red lead together with the well known water-repellant advantages of a silica-graphite paint. Under application it lessens the "drag" on the painter's arm and is not so severe on the wearing qualities of the brush as red lead. It will not chip nor scale off, has greater covering power than red lead, and costs considerably less.

Reflector Specially Designed for Bus Lighting

A REFLECTOR designed especially for 21-cp. lamps used in bus lighting has been placed on the market by the Ivanhoe Division of the Miller Company, Cleveland, Ohio. This reflector is of light opal glass



Opal Glass Shade for 21-Cp. Bus Lamp

which allows about 30 per cent of the light to be transmitted through it for general illumination and to light up the advertising racks. The reflector is comparatively deep and shields the lamp well. Approximately 65 per cent of the light is directed downward. The construction of the holder is extremely simple, and the usual fastening screw has been eliminated, thus reducing the likelihood of noisy rattling. Two types of reflector have been designed, one for use where the roof is flat, and the other where the roof slopes.

Asphalt Composition Rail Filler

THE Philip Carey Company, Cincinnati, Ohio, is putting on the market a rail filler of specially tempered asphalt composition. This acts as a resilient cushion between the rail and the pavement, absorbing traffic impact, rail vibration and traffic noise. It comes ready formed to fit any rail section and is readily shaped to fit any track curve. Moisture or temperature changes do not affect it.

The new rail filler is made to extend a short distance beyond the rail itself, so that the paving is laid not against the steel rail but against the filler, being thus cushioned against impact with the rail. The cost of installation is extremely moderate, as one man can place it in position with a mallet.

Association News & Discussions

Improvements in Motor Car Design*

Trends in the Design of Electric Railway Rolling Stock Considered from the Standpoints of First Cost and Maintenance—Bodies, Running Gear, Ball and Roller Bearings, Brakes and Other Parts Discussed

By H. Dubath
Engineer Swiss Industrial Company, Neuhausen, Switzerland

From the point of view of the running gear, double-truck cars present less variety than single-truck or two-axle cars. The two-axle cars are from 23 ft. to 33 ft. over bumpers, with wheelbase varying from 5 ft. 6 in. to 9 ft. or occasionally as high as 11 ft. with radial axles. With wheels of 31-in. to 37-in. diameters, as commonly used in Europe, determined by the size of the motors, the wheels are sometimes projected into pockets in the car floor. This arrangement is not held in much favor, drop platforms for the purpose of lowering the step height being considered preferable.

In many of the older car designs common in Europe the axles are supported directly from the body. In this type the point of attachment of the platform is always relatively weak, and requires heavy reinforcement.

The Americans were the first to build two-axle cars with the running gear separate from the body. This construction has numerous advantages, particularly due to the spring support of the greater part of the weight and to ease of repair, but it is heavy, the dead weight per passenger being in the neighborhood of 660 lb.

Replies to a questionnaire sent out by the author indicate that the large number of available types of trucks hinders the development of pressed steel designs, since the expense of dies limits the application to quantity production. It is not felt that the use of pressed-steel trucks increases the difficulty or importance of repairs. With the use of autogenous and electric welding processes repair work is facilitated and the total cost is likely to be less than for a running gear assembled of standard sections. Pressed steel for fabrication of trucks in quantity permits an economical proportioning of material, thus making possible a reduction in weight of the truck that may reach 20 to 25 per cent.

Light metals may be used advantageously for the purpose of reducing the weight of the truck in the construction of small trailers. For motor cars, however, the reduction in weight cannot be obtained without jeopardizing the strength and solidity of the truck. Light metals are useful for small parts and accessories where strength is not a controlling factor.

*Abstract of a paper presented at the biennial meeting of the Union Internationale de Tramways, de Chemins de fer d'Intérêt local et de Transports Publics Automobiles, Paris, June 16-21, 1924.

Elasticity of Body Suspension

The number of different spring suspensions of motor cars is in proportion to the importance of the subject. Laminated, helical and conical springs are all used. A good suspension should be cushioned, should have sufficient working range, and should be damped in action. Laminated springs alone combine these qualities. Helical springs are used frequently over the journal boxes, but this faulty construction is being abandoned.

Although satisfactory tests have been made of greasing laminated springs, the results do not justify extension of the practice. The collected dirt on the leaves cannot do other than harm their action. Furthermore, it is necessary to use leaves of special design, which increases considerably the price of the springs. It is believed that careful cleaning and lubrication of the leaves with oil and graphite will suffice to maintain the flexibility of the springs. Inspection of springs in service, however, indicates that frequently the laminations are allowed to rust in their guides, completely destroying the flexibility of the springs.

Laminated springs should have their leaves as long as possible, with very large section, assuring a stable suspension. For use in cars where the running gear is suspended from the body, or in the case of swiveling trucks without side play, the spring hangers may be connected through small helical springs carried in telescoping cases. This arrangement absorbs the minor shocks in order to reduce the movement of the leaves so that the latter may be supported directly from the body.

The exact calculation of axle stresses is not simple, for it is not possible to determine closely all the forces acting. Various experiments have now made it possible to establish an empirical relation taking account of all the influences. Breaks due to faulty construction or too small dimensions are relatively very infrequent. They start most frequently from flaws in the material resulting from molecular strain in consequence of the continued shocks sustained by the axle in service, and the breaks occur after a considerable number of miles have been traveled.

The use of high-quality steel is demanded in the manufacture of axles. Despite the high price of special materials, nickel steel and chrome-nickel steel have been tried by many companies with satisfactory results. The only exception is the railway in Algiers, which tried without success axles of 2 per cent nickel steel having a tensile strength of 62,000 lb. and 25 per cent elongation. These axles cracked when the distance run was only about 9,500 miles. This bad result is due undoubtedly to the poor quality of that particular steel.

Chrome-nickel steel is but little used on account of its high price. Its excellent qualities should now permit a reduction in size of the axles. This has been tried in the new cars of the Paris system.

In the following table are presented the characteristics of various special steels used in axles, as furnished by the technical head of the Swiss Railway Commission on secondary railways. These figures correspond quite closely with those furnished in response to the questionnaire sent out by the author:

Type of Steel	Siemens-Martin	Crucible	Nickel	Chrome-Nickel
Tensile strength, lb. per square inch	70,000–85,000	85,000–100,000	85,000–100,000	100,000–114,000
Elastic limit, minimum, lb. per square inch	50,000	57,000	62,000	71,000
Elongation, with a length between supports of 10 diameters, per cent	20	18	18	15
Elongation, with a length between supports of 5 diameters, per cent	24	22	22	18
Reduction in area, per cent	45	45	45	50

The following table gives current practice regarding the material used for the body of solid or spoked car wheels:

Type of Wheel	Spoked Wheels			Solid Wheels		
Material	Cast Iron	Soft Steel	Steel Casting	Soft Steel	Soft Steel Rolled	Steel Casting
Tensile strength, lb. per square inch	50,000–57,000	48,300–58,300	54,000	57,000	52,600–62,500	54,000
Elongation for length of 10 diameters, per cent	18	25	20	20	20	20
Elongation for length of 5 diameters, per cent	18	..	..	24	24	..
Reduction in area, per cent	35	50	..	50	45	..

Tires are most frequently made of Siemens-Martin steel, occasionally of crucible steel or electric furnace steel. The properties of the former materials are shown in the following table:

	Motor Cars		Trailers
Tensile strength, lb. per square inch	100,000–114,000 or 15	114,000–128,000 13–12	92,400–106,600 16
Elongation for length of 10 diameters, per cent	30–40	30–40	30–40
Reduction in area, per cent			

For tires, the same authority quoted above states that the material is satisfactory if the product of the tensile strength in lb. per square inch and the elongation is equal to or greater than 1,400,000. For the bodies of solid wheels with solid tires this is considered satisfactory, while cast steel should have from 70,000 to 85,000 lb. per square inch tensile strength with 12 per cent elongation and 30 per cent reduction in area.

The tendency is to permit the use of very hard tires having a tensile strength of 106,000 lb. per square inch or over. Tires of this sort may exert an unfavorable influence on track maintenance if the quality of the rails is inferior and if the curves are not carefully maintained. The outer rail may be seriously damaged, particularly where there is no spiraling at the entrance. This has been the experience of a number of companies which have used tires of a tensile strength from 107,000 to 114,000 lb. per square inch.

Ball and Roller Bearings

Only the results will be cited briefly of various trials and experiences in service with ball and roller bearings. In 1921 the Swedish State Railways supplied roller bearings to a series of ore cars with a light weight of 12.7 short tons and a weight fully loaded of 38.6 tons. In the course of a series of experiments made under similar conditions and comparing with ordinary friction bearings, the following results for train resistance were obtained at a speed of 25 miles per hour: For a car provided with ball bearings, 2.12 lb. per short ton; with friction bearings, 3.28 lb. per ton. This corresponds to a reduction of tractive effort of about 38 per cent in favor of the ball bearings. The starting resistance is reduced enormously, being not over 10 to 15 per cent of that obtained with cars having friction bearings. The tonnage of a train can be increased some 35 per cent without causing an overload on the motor.

Tests made on the tramways of Schaffhouse, Switzerland, have given equally favorable results with ball bearings. These tests, made in August, 1921, with a single motor car weighing 13.65 short tons and loaded with 2.2 tons showed a reduction in train resistance of 40 to 50 per cent, while the starting resistance was not over 35 per cent of that of the same motor car provided with friction bearings.

Unfortunately, the theoretical advantages of ball bearings are not sufficient to overcome the drawbacks. The high cost, about 2.4 times that of ordinary friction journal bearings, the breakage of balls, the abnormal wear on the journals following the rotation of the ball race and scoring of the ball race following shocks, are among the troubles which have caused an increase in expense of operation.

Summarizing, the author considers that ball bearings, on account of their delicacy, are not suitable for use in rolling stock.

Roller bearings are in use on several Swiss tramways, while others are waiting for the necessary funds to proceed with the substitution. A series of tests were made in March, 1923, by the German Rolling Stock testing department, of a car equipped with roller bearings. This test car, with a light weight of 53,600 lb. and carrying normally a load of 110,000 lb., was provided with roller bearings. The tests consisted of projecting the car against a shoe fastened to the rail, or against a loaded tender, at speeds of impact from 7 to 22 miles per hour. While in one case the impact was so severe that the end of the car was damaged, the roller bearings were in perfect condition throughout the test and after its completion. Measuring the bearing with a micrometer there was no deformation whatever, neither of the rollers or of the race.

For the use of roller bearings in electric cars it is not considered necessary to provide a special electrical contact between the journal box and the axle. The Swiss tramway companies and light railways, which have adopted roller bearings, have found the contact quite sufficient.

The cost price of the complete journal box for roller bearings is about 2.5 times greater than that for an ordinary friction journal box, although this may be reduced in quantity production. From the operating standpoint the economy of lubricants and the reduction of handwork in maintenance justify their adoption even at the present price.

Mechanical Brakes

The brake rigging used on tramway and light railway cars is in general heavy and complicated, and the cost of maintenance is always high. This latter may be reduced materially by the use of pins of tempered steel and by attaching a rod on the brake rigging to the journal boxes. The higher first cost of this arrangement will be quickly balanced by reduced cost in service. Then, also, the repair of the wearing parts on the rod by acetylene or electric welding will be found economical, and the use of steel bushings, at least in a number of cases, will be found advisable.

The necessity of reducing the dead weight of motor cars in particular, has led to experiments on the application to rolling stock of the principles now found in the design of automobile brake rigging, with braking by means of a drum placed on the axle.

The advantage of a brake drum for a motor car is that it may be placed in such a position as to reduce the initial force necessary to obtain the braking effort, and consequently permits a reduction in the weight of the brake rigging. This simple reason leads to the solution applied on automobiles, that of placing the drum on the motor shaft. [As an example of this style of brake rigging, the author makes reference to the Paris cars which were described in ELECTRIC RAILWAY JOURNAL, for Dec. 2, 1922, page 878.—EDS.]

Comparing the modern cars with the older ones, their simplicity and harmony of lines is noticeable. This has been accomplished by the elimination of useless accessories and simplification of shapes, all of which have gone to reduce the weight of the cars. Framing of wood is used in general, oak being the preferred material.

Panels are usually made of black sheet iron or of wood. In many cases sheets of aluminum of 1.5 mm. thickness have been used but the results have not been entirely favorable. Along the seashore the metal does not resist salt air very well and in some cases has been replaced with wood.

Another interesting result noted is the decomposition of the aluminum sheets at points where they are in contact with iron, the aluminum being reduced to powder in a few years. In Switzerland aluminum has been adopted for sheathing by many companies with good results. The weight of aluminum sheathing is about one-third that of iron, notwithstanding the greater thickness of the panels. The price is about 50 per cent more than that of sheet iron. The painting, however, is simplified and the paint is more durable on account of the absence of rust. In order to make the paint adhere well to the aluminum sheets they should be roughened with sand paper.

Train Signals

The management of the Zurich Tramways has tried a new system of transmission of signals between conductors of motor and trail car and the motorman, and has introduced with success an optical signal invented by H. Schaub, assistant engineer of the company.

The signals are given by means of lamps with colored lenses mounted in parallel on the trolley circuit. On each platform, motor car or trailer, a mercury switch is placed against the bulkhead so that its motor shaft projects through and permits the conductor to give the signals from the interior. The signal lamps are placed on each platform before the motorman.

The red lamps correspond to the motor car, and the green ones to the trailer. Signals are given in the following manner: (1) While the train is running the lighting of the red or green lamps or both indicates "stop at the next regular station." The start is not made until the lamps are all extinguished. (2) Successive lighting and extinction of either red or green lamps signifies "stop immediately" as signaled by one or the other conductor. As in the first case, the train is not started until all the lamps are extinguished.

On account of the frequency of operation (about 1,000 per day) it is necessary to use a special type of mercury switch. This has given excellent results, and has been tested up to four million of interruptions.

Metallic Car Framing

The considerations that have led to the construction of cars entirely of steel in America for car bodies of subways, suburban steam railways and later by large railway companies do not apply with equal importance to rolling stock for tramways or light railways. The design is very much less. Likewise the effect of speed on these latter in the

danger of telescoping does not exist to the same degree. The results on the cost of maintenance, however, may justify in itself this form of construction.

In Switzerland the Geneva Tramways placed in service in 1920 a set of 10 double-truck trailers, weight 11.65 short tons, seating 34, and having a total capacity of 64, being 363 lb. per total passenger. The frame is formed of pressed sheets 3 mm. thick, the sheets of the sheathing being of Siemens-Martin steel 2 mm. thick, those of the platform 2.5 mm. The posts and the car lines have furring strips of wood on the inside to which the sheathing or headlining is attached. To avoid rusting the frame and the running gear have been protected by the Schoop process.

One-Man Cars

Since the very complete report on this subject presented at the last congress by P. M. Nieuwenhuis, manager of the Arnhem Tramways, various companies have investigated the question. Everywhere the authorities have taken the point of view that safety of the system with variable fares does not make the extension of the use of this type of motor car desirable, yet one-man cars have been placed on certain lines of light traffic.

Standardization of Materials

The standardization of materials, desirable from all points of view, has encountered great difficulties. The enormous number of types of motor cars and trailers is evidently the natural consequence of varied and particular conditions of development in each system. Had the principle of standardization of materials been considered in the original plans, the promoters would have in a number of cases adopted approved types and exercised a good influence in the selection of material. Considerations often quite secondary have led to the opposite result, and the number of car types is growing greater and greater.

Today, the idea of standardization of material has made great progress. The ideal would be to limit the number of types to a few. The management of the electric railway of Little-Roubaix-Tourcoing gives the following statement on the subject:

"If we consider the city and interurban tramway systems, except Paris, it appears that the types of cars necessary may be reduced to four:

"A two-axle city type motor car of 42 to 45 passengers capacity, with two motors of 35 hp. each and a total weight of 10 (metric) tons;

"A two-axle city type trailer of the same capacity, weighing 5 tons;

"A double-truck interurban type motor car of 55 to 60 capacity, with power determined by the demand;

"A double-truck interurban type trailer of 55 to 60 capacity.

"In the case of those concerned with the two former types, the leading question is the wheelbase, which may not be settled easily, not all parties being agreed on the possibilities of a car with two rigid axles and a wheel base of 3.5 m. (11 ft. 6 in.) going around curves of 18 m. (60 ft.) in an economical manner."

For motor cars, this last point is solved in a very satisfactory manner by the elastic suspension as used in the light motor cars of the Paris system, the motor not being mounted on the truck.

But standardization does not apply alone to new equipment, and first cost and maintenance may be reduced proportionally by the standardization of the principal car parts.

On the Swiss tramways and light railways alone, we have taken account of at least 100 types of tires, for example. Under such conditions, replacements are very costly, and the delays in delivery are always very long on account of the low tonnage requirements. It is therefore indispensable to work for standardization of these and similar parts, to permit manufacture in quantity.

Excepting for the electrical equipment the author proposes the standardization of the following parts:

Axles, wheel bodies, tires, journal boxes, suspension springs, brake rigging, brake beams, brake shoes, couplers, parts of the car body framing, truck parts, pressed steel parts, glass and window frames, ferrules, etc. This will have not only a favorable influence on the first cost and on the maintenance of these parts, but also on the weight of the car. Standardization of this sort is particularly desirable for the smaller companies which find it impossible to obtain the advantages of construction of cars in quantity on account of their limited requirements.

Reduction of Car Weight

As shown in this paper there are several factors that can produce a reduction in car weight. The dead weight carried per passenger is evidently too great, especially for tramway motor cars. Thus the mean established for the motor cars of 13 companies responding to the questionnaire give the following proportions: Weight empty, 14.2 short tons; seats, 28; total passengers, 56; giving a dead weight per seat of 1,015 lb. and of 508 lb. for all passengers.

In Switzerland the average of all tramway motor cars is less favorable. This is due principally to the heavy grades, necessitating extra strong brake rigging, magnetic track brakes almost universally adopted, a very strong construction, capable of standing frequent and prolonged brake applications. The average figures follow:

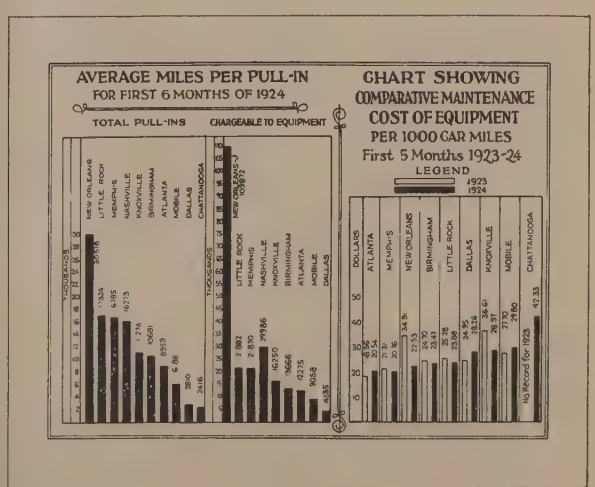
Weight empty, 11.3 short tons; seats, 18; total passengers, 35; being a dead weight of 1,250 lb. per seat and 645 lb. with respect to the total carrying capacity.

The new light weight motor car, Type L, of the Paris system, has a light weight of 13.8 short tons; seats, 30; total capacity 49; dead weight per seat 920 lb.; dead weight per passenger 563 lb.

Southern Equipment Men Mix Fact and Fancy

A FEATURE of the meeting of the Electric Railway Association Equipment Men, Southern Properties, held at Erie, Pa., July 23 and 24, 1924, was the attractive booklet distributed to the members present. Fact and fancy were judiciously mixed in the preparation of this booklet. The front and back covers showed W. H. McAloney, superintendent of equipment Georgia Railway & Power Company, Atlanta, Ga., and J. M. Kington, master me-

ELECTRIC RAILWAY ASSOCIATION EQUIPMENT MEN
SOUTHERN PROPERTIES
CHARTS SHOWING AVERAGE MILES PER PULL-IN
AND MAINTENANCE COST PER 1000 CAR MILES
First Six Months 1924
IT'S HELL BOYS BUT WE HAVE TO DO IT !!!
EDDIE GUNN LOW EF HE'D USE GEN'AL 'LECTIC MOTORS DEY'D RUN DEYSEVES
GENERAL ELECTRIC CO'S FACTORY
Erie, Penn.
July 23-24, 1924



Front Cover and One of the Interior Pages of Southern Equipment Men's Booklet

chanic Knoxville Power & Light Company, Knoxville, Tenn., in characteristic poses. The interior of the booklet was devoted to charts showing the average miles per pull-in and the maintenance cost per thousand car-miles on the various railways connected with the association.

Pacific Claims Men Discuss Safety Measures

STAGING of a general "accident prevention day" on the Pacific Coast, advocation of compulsory liability insurance for all autoists, concrete suggestions for new traffic rules, standardization of accident reports in all cities and recommendation that new autoists be required to pass examinations in order to obtain new licenses were the principal topics of discussion at the fifteenth annual convention of the Pacific Claim Agents Association, Spokane, Wash., June 23-25.

S. A. Bishop, general claim agent Pacific Electric Railway, was elected president of the association, to succeed P. O. Solon of Oakland, Calif. Other officers elected are V. F. Bennett, first vice-president; C. R. Peck, second vice-president; F. J. Furman, third vice-president; and B. F. Boynton, secretary-treasurer. The new executive committee consists of J. H. Handlon, chairman; Colonel Thomas G. Aston, H. G. Winsor, W. H. Moore, C. A. Blackburn, F. D. Oakley, H. K. Relf, A. M. Lee, C. M. McRoberts and P. O. Solon.

Internationaler Strassenbahn und Kleinbahn Verein

THE program for the convention of the Internationaler Strassenbahn und Kleinbahn Verein, or the Association of Street and Interurban Railways in the central countries of Europe, has just been made public. The convention, as already announced in the paper, is to take place at Homburg, v.d. Höhe Sept. 4 to 5. A list of the papers to be presented and their authors follows:

1. "Operation of One-Man Cars and Their Possibilities in the Way of Reducing Platform Expenses"; by Mr. van Putten of Amsterdam and Mr. Hultman of Malmö.

2. "The Automobile in Supplementary Service to Interurban Railways"; by Mr. Geiser of Schaffhausen.

3. "Rating Transportation Employees on the Basis of Car Miles Operated per Year"; by Mr. Nórregaard of Copenhagen.

4. "Determination of a Reasonable System of Fares for Street Railways"; by Dr. Patz of Budapest.

5. "Track Construction and Maintenance"; by Mr. Goetz of Leipzig.

6. "Standard Sections for Girder Rails"; by a member of the committee on standards.

7. "Magnetic Track Brakes"; by Mr. Barth of Christiania.

8. "Controllers and Control Sys- by Mr. Pforr of Berlin.

9. "Practical Experience with Self-Ventilated Motors"; by Mr. Nier of Dresden.

10. "Roller and Ball Bearings for Electric Motors and Car Journals"; by Dr. Videky of Budapest and Mr. Pforte of Hagen.

11. "Fares in Non-Expanding Territories"; by Mr. Winter of Vienna.

The business session of the association for the election of officers, etc., wi take place on the afternoon of Sept. On Sept. 6 and 7 the German Stree and Interurban Railway Associatio will meet.

American Association News

Plans for Annual Convention

ARRANGEMENTS for the Annual Convention to be held in Atlantic City Oct. 6-10 are progressing. Nearly all the acceptances for the program have been received. Expectations are that it will be ready to submit to the membership, at least in tentative form, by the end of this month.

Committee reports are being received from the chairmen, and the work of editing and printing is being followed up as rapidly as possible. There are, however, some reports that have not been received, and it is hoped at association headquarters that they will be in hand so as to insure distribution prior to the convention.

Annual Convention and Exhibits

A. E. R. A.

Atlantic City, N. J.

October 6, 7, 8, 9, 10

Engineering Association Nominations

THE nominating committee of the Engineering Association, John Lindall, chairman, announces the following nominations for officers and members of the executive committee for the coming year:

President, C. H. Clark, engineer maintenance of way Cleveland Railway, Cleveland, Ohio.

First vice-president, R. C. Cram, engineer surface roadway Brooklyn-Manhattan Transit Corporation, Brooklyn, N. Y.

Second vice-president, Charles R. Harte, construction engineer The Connecticut Company, New Haven, Conn.

Third vice-president, Daniel Durie, general superintendent West Penn Railways, Connellsville, Pa.

Secretary and treasurer, James W. Welsh, executive secretary American Electric Railway Association, New York, N. Y.

Members of executive committee: R. H. Dalgleish, chief engineer Capital Traction Company, Washington, D. C.; E. H. Scofield, engineer power and equipment Twin City Rapid Transit Company, Minneapolis, Minn.; M. B. Rosevear, superintendent of distribution Public Service Railway, Newark, N. J.; Frank H. Miller, vice-president Louisville Railway, Louisville, Ky.

City and Interurban Operation

THE committee on editing appointe at the St. Louis joint meeting o the committee on city operation an the committee on interurban operatio met Aug. 8 at association headquarter in New York. Those present wer G. C. Hecker, J. S. Bleecker, G. W Welsh and Morris Buck.

The contributions submitted by th regional vice-chairmen for the hand book were read and judged for publica tion with a view to selecting carefully for inclusion in it those descriptions o practices pointing the way to improve ments that can be of value to othe properties.

It was decided that the entire joint report of the two committees shoul be followed by the reports of the regional vice-chairmen, as this metho will eliminate duplication and present the discussion in more logical form.

The reports of the regional vice-chairmen were read. It was found that each treated the subject matter from a different viewpoint. All but one of the regional vice-chairmen has presented a report for inclusion in the annual report of the committee. Work on the handbook is progressing in line with the recommendations made.

Special Reports Available

THE following special reports have been prepared by the Bureau of Information and Service of the American Electric Railway Association and are available to member companies in good standing upon request:

Electric Railways Operating Buses: A revision of the compilation of March 1, 1924, bringing up to date the data on number of routes and buses operated, type of bus and seating capacity, fare charged and transfer privileges of approximately 166 electric railways.

Trend of Electric Railway Operations: A month by month record of the traffic, revenues, expenses, taxes, car-miles, operating ratio, etc., of a group of 80 companies. Graphic curves showing the principal trends are presented to illustrate the figures, bringing the record of operations down through May, 1924.

Traffic Ratios — Part III, Combination City and Interurban Lines: There is shown for each of about 85 companies the average speed, revenue passengers per mile of track, per car-mile and per car operated, operating ratio, revenue per mile of track, passengers per car-mile, operating income per mile of track and other ratios.

Electric Railway Fares in Cities of More than 25,000 Population: A brief summary of fare systems and rates in each city, with a general summary reviewing changes which have occurred in recent years.

Relief from Paving Charges: Tabulated summary of 48 cases in which electric railways have been relieved either wholly or partially of the burden of maintaining the pavement between their tracks.

In addition to the above, supplements to the Wage Bulletin, Fare Bulletin and Cost of Living Studies have been prepared, bringing them down to date.

The News of the Industry

$700,000 Spent for Track

Large Expenditure Made by Detroit Municipal Line Last Year for This Item Alone

More than $700,000 has been expended by the Department of Street Railways at Detroit during the last year for track construction, repair work, rehabilitation and extensions. A summary report by H. M. Gould, acting assistant general manager, discloses this fact. Major operations undertaken by the department during the year are divided in the report into five classes: New trackage constructed, special trackwork renewals, track reconstruction, major track repairs and work required in connection with the widening of twenty-one streets, the cost of which to June 30, 1924, was $53,000. The cost of completing this work is estimated at $111,650.

According to Mr. Gould's report, since May 15, 1922, when the city lines of the Detroit United Railway were purchased by the city, consistent and steady progress has been made toward rehabilitation of the property so acquired, new cars have been placed in service, in part replacing obsolete cars, trolley wire and overhead equipment renewed, power station equipment overhauled and repaired and track and pavement reconstructed. At the same time additional track mileage has been constructed and detail studies have been made to cover service for districts not now served with transportation.

SUMMARY OF WORK PRESENTED

New trackage cited includes four streets totaling 23,601 lineal feet of single track, part standard monolithic type construction and part open type construction.

Special trackwork renewals have been made in numerous locations where the life of the old special trackwork has been exhausted. The total of this special trackwork is 270 tons.

Track reconstruction was carried out on six streets where the former tracks were built in 1894, 1895 and 1909.

By major track repairs is meant the complete uncovering of the track to its very foundation; the tightening of the existing rails and ties on the foundation and the repair of the track joints by cutting in new pieces of rail where joints are broken down, and the placing of a new pavement.

Major track repairs are shown on fourteen streets. A summary follows:

Old track joints replaced	850
Lineal feet of straight rails resurfaced and relined	95,000
Square yards of pavement replaced	26,000
Cubic yards of concrete foundation replaced	1,000
Feet of rail corrugations ground	90,000

The report points out that numerous individuals and various associations have, from time to time, taken up with the Department of Street Railways the matter of extending service into districts not now served. In order to handle this very pertinent subject in an intelligent way the department has set up a traffic survey crew. The function of the members of this body is to make detailed studies of the sections involved, taking a house-to-house canvass to determine the exact number of potential car riders as part of the effort to procure what the Department of Street Railways considers a very necessary arrangement—transportation through co-operation. In a territory approximately 21 square miles in area the total cost of the survey was approximately $40 per square mile. These studies are designed to aid both the petitioner and the Department of Street Railways in determining the most economical and feasible type of transportation where it is shown that transportation is required. The sections now being studied embrace an area of approximately 41 square miles.

Fare Cut Denied to Cities

Commission Holds Connecticut Company's Rate Reasonable—Bridgeport Fare Advanced—Segregation Denied—In 1923 Company Earned About 4½ per Cent on Its Investment

THE token fares established by the Connecticut Company, that is, three for 25 cents, were recently declared reasonable by the Public Utilities Commission. Thus did the commission establish a uniform rate for all lines operating in Connecticut, as was referred to in the ELECTRIC RAILWAY JOURNAL of Aug. 2. This opinion was handed down in denying the petition of the cities of Hartford, New Haven, Waterbury, New Britain and Stamford, for reduction in fares. The rate in Bridgeport was ordered increased from 7⅓ cents, or two tokens for 15 cents, to 8⅓ cents or three tokens for 25 cents. In doing this the commission refused to make any segregation of the company's system.

The commission finds that the company in 1923 earned about 4⅓ per cent on its total investment. It said that if proper deduction for depreciation were made and a fair and reasonable estimate of present value ascertained, the rate of return now being earned would be considerably less.

The company received from all sources of revenue in 1923 about $14,780,000. After deducting wages, maintenance of property, state and municipal taxes and other general expenses, a balance of $2,530,000 was available for depreciation, return on property and reasonable surplus. The passenger revenues for the period Jan. 1 to Feb. 10, 1924, continued falling off at the rate of more than $1,000,000 a year. At the end of that period the 8⅓ cent token fare went into effect, except for the city of Bridgeport and adjoining communities. Revenue for the first three weeks subsequent to that fare increase after excluding Bridgeport showed an increase of 9 per cent when compared with the three weeks preceding Feb. 10, which were under the 7⅓-cent token fare. In addition, the company still owes the state of Connecticut nearly $802,000 in overdue and unpaid taxes.

The commission stated that the New York, New Haven & Hartford Railroad requested that it be allowed to intervene to the extent of asking that the Connecticut Company be accorded the right, if it could, to earn a fair return on the fair value of its property. For this purpose it made a statement covering the financial relations of the two companies since 1910, the year in which the Connecticut Company acquired its properties from the New Haven road. During this period the New Haven road has expended in interest on underlying bonds of the Connecticut Company about $10,000,000, and $2,500,000 for retirements and contributions to the sinking funds of these bonds. The New Haven has advanced the Connecticut Company in the same period the sum of $6,750,000, of which $500,000 has been repaid. The New Haven Company now holds $1,000,000 of overdue debentures, about $4,569,000 in demand notes, both issued by the Connecticut Company, as well as the beneficial ownership of the $40,000,000 of capital stock, or a total present investment of about $45,569,000.

In the matter of segregation the commission stated that the different cities asking segregation of the company's system offered no suggestions as to what territory outside of the city proper, each forming the nucleus of a division, should be included, and confined themselves to a claim that certain lines now included in the present divisional arrangement should be excluded. The commission said that since it appears conclusively that no division as at present constituted was earning a fair return on the fair value of the property in that division, it was obvious that there could be no advantage in regrouping of existing divisions resulting in an increase in the rates of some and probably in no case resulting in a decrease in rates for others. Further, it stated that the only advantage to be gained in a regrouping of the

system into other operating and accounting divisions, would be the establishment of a rate of fare which might be lower for some divisions so created, although higher for others. Such rearrangement, no matter how carefully planned, would not eliminate certain fixed charges and inter-related expenses applicable to the company as a whole, and which would have to be allocated among the several divisions.

The commission said that in the absence of power to abandon non-paying lines, there might be a question as to the right to segregate the corporate property of the company into separate rate areas, as this would result in confiscation of that part of its property located in non-paying sections.

TOKEN FARES DECLARED REASONABLE

The commission said, therefore, that, based upon the foregoing, it was of the opinion that the token fares established by the company, to wit, three tokens for 25 cents, were not unreasonable; that the token fares in Bridgeport and adjoining communities should be increased from 7½ cents or two tokens for 15 cents, to 8⅓ cents or three tokens for 25 cents, and that the commission was not justified at this time and in these proceedings to make any arbitrary segregation of the company's railway system or to change the existing divisional lines. It was therefore ordered that the petitions of the cities of Hartford, New Haven, Waterbury, New Britain, and Stamford be denied. It was further ordered that the petition of the Connecticut Company for an increase in the token rates in Bridgeport and adjoining communities be granted, and the company was authorized and directed to establish and put into effect on and after Aug. 3, 1924, a token fare of 8⅓ cents or three tokens for 25 cents on the Bridgeport lines where the 7½-cent token fare was in effect.

New Power Rates Beneficial to Toledo Company

The City Council at Toledo has approved a rate settlement between the Community Traction Company and the Toledo Edison Company which will not jeopardize the interests of either company in present court and utilities commission actions, but will benefit the railway by assuring it a material saving in power costs. The new rate is retroactive to April 1 and approximates 1.3 cents a kilowatt-hour, showing a saving of about 3 mills per kilowatt-hour over the old rate. This amounts to a flat saving of more than $7,000 a month.

As compared with a similar period last year the company payrolls are showing a saving of approximately $30,000 monthly. In June this saving was $31,752.

Indianapolis Considers Bus

The use of buses to supplement city railway service is being considered by officials of the Indianapolis Street Railway, according to Robert I. Todd, president of the company. He said that definite action would be taken by the board of directors of the company after extensive surveys are completed concerning the advisability of their installation. If the buses are put in operation, they would be used to transfer passengers between lines at certain designated points and as extensions to car lines in rapidly growing sections of the city. The question of the company operating buses was brought up when officials of the company appeared before the City Council with a request for a fare increase. At that time members of the Council asked for information on the bus system and the company explained that because of its financial condition it would be impossible even to consider the matter. However, the company officials have decided to institute a survey, the result of which will decide the question of bus installation.

Port Huron's Anti-Safety Flurry Is Ended

Street cars were restored to service in Port Huron, Mich., on Aug. 9, and all but the bus men were happy. Service over the electric railway was shut down on Aug. 4 when the City Electric Railway (Detroit United Lines) started the operation of one-man cars. Hugh E. Stringer, chief of police, parked his car across the rails, as evidence that he was with Mayor McIlwain and the City Commission in their opposition to one-man car service.

As the company clearly could not afford to continue running twenty-four seat cars with two men each and at a 5-cent fare, it looked as though a long drawn out lesson in transportation economics was in store for the 35,000 inhabitants of Port Huron and their thousands of summer visitors. Happily this did not prove to be the case. The public had already secured most of its education vicariously through the troubles of Neighbor Saginaw. It had no desire to go through the same mutual recriminations and losses. An ordinance passed by the City Council required that service be restored by Aug. 7 under penalty of the loss of the franchise.

Pending a settlement of the dispute with the railway the city granted operating permits to a collection of motor substitutes ranging from the finest interurban multidoor de luxe coach to the shabbiest touring wreck. But every blessed one of them charged 10 cents and only one operator who owned several coaches did anything to make free transfers effective and his was a feeble effort. The realization that they were in for double and quadruple fares on vehicles operated by one man brought the public and its official sentinels to a rapid recognition of their inconsistency in opposing one-man direction of the cheaper, more commodious and tax-paying trolley.

That's why the City Commission accepted on Aug. 7 the suggestion put forth by Elliott G. Stevenson, president of the railway. He proposed that:

1. Service be restored on the basis of 50 per cent one-man cars and 50 per cent two-man cars, so that patrons can become acquainted with each.

2. The people be permitted at the election of Sept. 9 to decide this question: Do you prefer one-man car operation at 5 cents or two-man car operation at 7 cents?

The suggestion thus advanced was accepted.

First De Luxe Bus Run by Detroit Municipal

Ross Schram, general manager a other officials of the Department Street Railways at Detroit, made trial run of a Fageol fifty-eight-se double-deck bus through the Gros Point district and other places on Au 8 as the first step toward the expansio of the city's activity in this field. announced in the Aug. 9 issue, the D partment of Street Railways is pla ning to go into the bus field in a larg way than its present operation of a fe supplementary buses and the Belle Is Service.

The six-cylinder bus, borrowed f the occasion, is of the low-hung pne matic-tired type with the wheel a axle housings placed so that there is n interference with the seats. T twenty-six seats on the lower deck a of the transverse type, upholstered soft leather and of ample width for tw wide-gage riders. The upper deck, sea ing thirty-two, comprises a longitudin back to back bench made of heav wicker weave and formed to perm comfortable, non-sliding riding. T bright color of the bus and its decora tion with the city's seal (now d calcomaniad on all cars as they g through the paint shops) attracte much attention. During the run, th bus was stopped at one of the ca houses where it was subjected to va uable comment by conductors an motormen.

The following statement was issue by the Street Railway Commission:

The sincerity of the Street Railway Com mission in the matter of the plan for bu operation having been questioned by one the papers, we wish to state that the can be no doubt as to our sincerity in t matter. The question has been studied b the commission for many months with th special assistance of William B. Mayo. has been discussed with Mr. Martin, a Acting Mayor, and the general policy ha been agreed upon by the officials concerne merely awaiting final detail recommenda tion from the operating staff.

The question of ordering or non-orderin of a definite supply of buses is not at thi time important, as orders can not be give until we have a definite recommendatio from the operating department upon whic to act and with which to go before th Council for proper authorization.

In so far as the ability of the commissio to obtain buses is concerned, we wish t state that we have definite assurance o the delivery of from 75 to 100 chassi within ninety days, of course, subject t our approval of that design of vehicle.

Mr. Mayo, chief engineer of the For Motor Company, was formerly genera manager of the D. S. R., and is stil associated with the department in consultant capacity.

Paving Being Done by Court Direction

Paving is under way between tracks in the village of Grandville, Mich., by the Michigan Railroad, now operating under Stewart Hanley, Detroit, receiver. The paving will be of brick and will be around a single track instead of a double one over which the company's cars hitherto passed. The strip to be paved is a mile long. It will cost about $57,000 to carry out the work. The construction follows a dispute of some years standing. After many months in court the railroad was ordered by the Supreme Court of Michi-

an to pave, but this was not done, mpany officials saying material was t then available. Recently resi- nts took matters in their own hands d blockaded the tracks. Their action d to the hastening of the appointment a receiver by Judge Clarence Ses- ons in United States District Court petition of certain Chicago inter- ts. The federal court ordered that part of his duties as receiver, Mr. anley see that the work of paving as done.

. Louis Bus Company Changes Original Petition

The St. Louis Bus Company applied Aug. 6 to the board of Public Service St. Louis for permits to open four utes from outlying sections of the y to the downtown district. This was decided departure from the originally nounced policy of the new organiza- n, to furnish supplemental service to e cars of the United Railways with ansfers from bus to street car and ce versa.

Two of the routes sought are vir- ally the same as those for which the ople's Motorbus Company now has plications on file. The others con- ct with plans of the rival bus com- ny also. The formation of the new s company followed the failure of the organization committee of the United ilways to come to terms for the rchase of the People's Motorbus mpany and the rejection by the lat- r organization of the plan of Col. bert T. Perkins, general manager for e United Railways, to furnish supple- ental service to street cars with an terchange of transfers.

Mayor Henry W. Kiel of St. Louis nferred with the organizers of the . Louis Bus Company on Aug. 5 and expressed the belief that supple- ental bus service as originally anned by the new company was not fficient, contending that the people anted through service on buses. The ange in the plans of the St. Louis is Company resulted from the con- rence with Mayor Kiel. The Mayor s just returned from a trip to Lon- n where he attended the convention the Advertising Clubs of the World. e is said to have informed interview- s that he considers surface street cars solete and regards motor buses d subways as the modern method of ndling metropolitan transportation. The new company plans to permit a ansfer system with the United Rail- ys and all money earned above a ir return on its invested capital will given to the United Railways. Later nen the United Railways reorganiza- n is completed the bus lines will be- me part of the railway system. A ntract is being drawn up to permit fair adjustment on transfers between e buses and street car, subject to the proval of the United States District urt and the Missouri Public Service mmission.

The Board of Public Service at its eeting on Aug. 6 considered the ap- ications of both the St. Louis Bus mpany and the People's Motorbus mpany for the new permits but took final action.

Portland Electric Power Seeks Crosstown Bus Franchise

Formal petition for municipal franchises for the operation of "cross-town" buses at railway fares, and with car transfer privileges, has been filed with the City Commissioners in the form of a proposed ordinance, by the Portland Electric Power Company, Portland, Ore.

The franchise requested in the petition provides primarily for the operation of buses as an extension of the railway service. It also provides for the optional operation of buses in either or both directions on a number of additional streets in the city.

Duration of the franchise has been fixed at six months, Mr. Fuller explaining that the contemplated service is merely an experiment. Provision is made that if unusual storms or snowfall tie up the service, the franchise shall not be revoked if effort be made in good faith to continue such service.

The proposed ordinance stipulates that bus fares shall be the same as those charged on carlines operated by the company, and that passengers shall be entitled to the same ticket rates, transfers and other privileges as are granted railway patrons.

The company will provide for property damage insurance in the sum of $1,000 and liability insurance covering personal injury in an amount not less than $10,000 for one person in any one accident, and not less than $20,000 for all persons receiving personal injuries by reason of any one accident.

Continuation of the service and the operation of extensions thereto, will depend upon the financial returns of the experiment.

Bus Terminal Interest Acquired by Twin City Company

As the result of its purchase of the Twin City Motor Bus Company, announced in the issue of ELECTRIC RAILWAY JOURNAL for Aug. 9, the Twin City Rapid Transit Company, Minneapolis, has acquired the bus company's interests in the Union Bus Terminals in both St. Paul and Minneapolis.

The Minneapolis Depot is owned equally by six bus companies, and the St. Paul terminal by seven. The Twin City Motor Bus Company held an equal share with the other companies in each terminal, and under the terms of the purchase the railway acquires this interest as well as the other physical property of the bus line.

Contracts between the members of each depot company give the company the option to purchase the interest of any stockholder who desires to sell. Each participating stockholder cannot own more than a fraction of the total stock equivalent to the number of members in the terminal at any time.

Both the railway and the bus lines have expressed a willingness to continue under the original arrangement, so that the buses acquired by the railway in the purchase of the Twin City Motor Bus Company will continue to use the terminals as heretofore. The railway has become a participating member in the management of the two terminals. H. L. Bollum, general manager of the railway's bus interests, is a member of the board of directors of both the Minneapolis and the St. Paul Depots.

Orders Three-Cent Charge for Transfers

Replying to the demand of the city of of Tacoma, Wash., that it receive 3 cents for each transfer of the Tacoma Railway & Power Company taken up by the municipal car line, the company has made a counter proposal that the city and company take up each other's transfers without collecting anything for them. The proposal was submitted to the Council by E. J. Rounds, superintendent of the traction company, and referred to Mayor A. V. Fawcett, who has charge of the municipal line. The Mayor and the Council upon consideration, refused the company's offer, and notified the company that its transfers would not be honored on the municipal line unless the company agreed to pay 3 cents for each transfer collected by the city. Mayor Fawcett presented to the Council figures showing that the city would lose about $250 a month by adopting the system proposed by the company.

Ten-Cent Fare Sought in Johnstown

The Johnstown Traction Company, Johnstown, Pa., has filed with the Public Service Commission a new schedule of rates to become effective Sept. 5. The tariff provides for an increase to 10 cents, or four tickets for 30 cents. The present fare is 7 cents or four tickets for 28 cents. Special tickets to school children will remain at 5 cents.

The increase is made necessary, according to Manager Shannon, by the increasing demands for public improvements, street paving, relocations of tracks and in maintaining the present high standard of service. The increase in the use of the automobile has resulted in a decrease in railway receipts. In May, 1924, receipts were $99,761 as compared with $108,502 in May, 1923, in June receipts were $90,676 compared with $105,233 in June, 1923. July receipts for the first twenty-four days amounted to $68,351 compared with $82,624 in July, 1923.

Buffalo Bus Hearing Set for September

At the conclusion of the hearing before the City Council of Buffalo on the application of the International Railway and the VanDyke Motor Bus Corporation to operate a fleet of double-deck buses in Buffalo on a 10-cent fare, Mayor Frank X. Schwab said he would proclaim a transportation emergency existed on certain avenues and streets in the city and permit the operation of buses without the consent of the City Council or Public Service Commission.

Neither the International Railway nor the VanDyke Motor Bus Corporation would indicate whether it would take advantage of the proposed emergency order of the Mayor in view of

the fact that a similar order was issued during the last street car strike and the higher courts of the state ruled buses were being operated illegally and ordered the Mayor to revoke the emergency permit.

It was evident that the City Council sought to sidestep definite action on the applications of the two companies for consent to operate buses in Buffalo so that the matter could be taken up with the Public Service Commission of the state. The Council said it would reconsider the applications early in September after the summer adjournment of the Council.

Mayor Expected to Report Soon on Chicago Purchase Terms

A special meeting of the City Council will be called during the summer recess to consider Chicago's traction problem. Several days ago Mayor Dever revealed that this was his plan. Whether he will submit a definite suggestion looking toward the municipalization of the traction lines of the city at that time or will report failure in the negotiations, the Mayor would not say.

The conferences called by the Mayor with officials of the Chicago Surface Lines and the Rapid Transit Company are nearing an end. The Mayor is awaiting definite figures from Samuel Insull, chairman of the board of directors of the elevated, touching certain phases of the valuation. These figures will be among the matters presented to the City Council, according to present plans.

Within several weeks at the latest, it is expected, the City Council will have before it the verdict of the Mayor and his traction advisers respecting the wisdom of the plan to purchase the existing lines at the price set upon them by the representatives of the various companies.

More Moves Made in Minneapolis

Significant events continue to follow each other rapidly in the history of the Minneapolis Street Railway, Minneapolis, Minn. The latest development is an attempt by the socialist-labor aldermen in the City Council to force the hand of the Minnesota Railroad & Warehouse Commission to reduce fares to 5 cents from 6 cents, with free transfers. Another move is the introduction by Alderman A. R. Gisslen of an ordinance to permit operation of jitneys in competition with the street cars. He said:

> In case the Railroad & Warehouse Commission does not find in favor of the city for a 5-cent cash fare with six rides for a quarter, we will run the railway out of the city.

The commission has practically finished the work of taking testimony in the Minneapolis Street Railway valuation case and a decision is expected before the end of the year as to a permanent rate of fare.

The jitney ordinance would be effective Oct. 1. It is proposed that the Council shall fix rates of fare and routes; that all jitneys must get city license, in the application giving names of drivers, provide a minimum bond of $10,000 liability for each bus with insurance of at least $5,000 for any person injured or killed; that each bus must pay annually $25 for each 7-passenger capacity, plus $2 for each additional seat; and loading must not be more than 50 per cent above seating capacity.

Jitneys were formerly operated, but they were withdrawn under the terms of a gentlemen's agreement that the Council would issue no jitney licenses.

O. J. Turner, chairman of the street railway committee of the Council, opposes the view favorable to the jitneys. He said the jitneys would take the short haul or cream trade and thus deprive the railway of the main source of passenger revenue. This would result in either decreased service or higher fares. He said:

> Under the state control act the fare is based on cost of service and the City Council should co-operate with the company in reducing service costs to the minimum.

Free bus service is offered to Glen Lake Sanatorium by the Twin City Rapid Transit Company. Buses are operated between Minneapolis and the sanatorium and the Yellow Cab Company competes with taxicabs marked "Fare same as bus fare to Glen Lake." Now the suburban trolley offers free bus service from Glen Lake station to the sanatorium. Commutation and regular tickets from Minneapolis include bus transportation at the regular cash fare of 24 cents or commutation fare of 20 cents.

Railway Extensions Proposed in Oakland

The Key System Transit Company, serving the East Bay cities in California, in addition to two bus lines in Alameda and three in Oakland, is planning two electric line extensions as a result of the traffic survey now in progress.

The first of these will give Piedmont easier access to San Francisco. In all, this will include about a half mile of new trackage along an old right-of-way never before used by the company and partly along tracks used by another line. Work has already been started on this line.

Piedmont, a city that adjoins Oakland, has applied to the State Railroad Commission for a transfer privilege from the cars of the traction company serving that city to Key System trains running to the San Francisco ferry. The new extension is a compromise on this matter.

The second electric line extension planned is one in Oakland. This will include about 1,000 ft. of trackage up Trestle Glen, serving the Glenview district, residents of which also are seeking more direct means to reach San Francisco than are at present afforded. Trains of the Key System Transit now run part way up the Glen, a district recently developed by a realty concern.

Strike Because of One-Man Cars.—The motormen and conductors of the Slate Belt Transit Company, Pen Argyl, Pa., which operates between Bangor and Nazareth, went on strike on Aug. 1 when they were asked to operate one-man cars between Wind Gap and Nazareth.

Authorities Differ Over Brooklyn Wreck Findings

Two official reports have been made in regard to the wreck on Aug. 5 at the Ocean Parkway elevated station of the Brooklyn-Manhattan Transit Corporation. One is by the New York State Transit Commission and the other by the Board of Transportation of the City of New York. The conclusion reached in both cases is that the brakes were applied too late to prevent the collision. No defects were found in the air brake equipment which might have prevented the proper application of the brakes.

The reports of the two commissions differ principally in the opinions that are expressed in regard to the question of the use of wooden cars versus steel cars for elevated service. The leader train, which was stationary at the platform at the time of the accident, was made up of steel cars while the so-called follower, which rammed the train ahead, was composed of wooden cars.

The report of the Transit Commission states that the operating motor car of the wooden-car train telescoped the rear car of the steel-car train for a distance of 13 ft. In doing so the under frame of the wooden motor car was forced under the rear of the steel car and the forward truck of the wooden car was pushed back so that the brake cylinder head of wooden car was broken. The entire side body frame on each side of the wooden car was demolished and the motorman's operating cab was forced back 6 ft.

The second car of the train made up of wooden cars was in turn telescoped by the front car for 10 ft. The drawbars between the cars were broken and the platform and forward bulkhead of the second car were demolished. The rear platform of the third car of the wooden-car train buckled and the buffer timbers broke. The remaining three cars were only slightly damaged.

The rear truck of the last car of the steel train was pushed forward and the drawhead was broken off. Other than this, the cars which made up the steel train showed no signs of damage.

The discussion as to whether there would have been less damage had both trains been composed of steel cars appears to hinge about the contention that due to the qualities of greater resistance to shock inherent in steel cars there is more danger of cars of this type being derailed and thrown from the elevated structure in case of collision than there would be in the case of wooden cars. The contention has also been advanced that in case of collision between steel cars on an elevated structure the cars would be likely to buckle while with wooden cars their superstructure would be demolished, but the cars would continue in the general direction in which they were headed without danger of derailment or of being thrown from the structure.

The Transit Commission takes the stand that the wooden cars were safe and adequate for elevated operation. The Board of Transportation maintains that the equipment was old and obsolete and consequently unfit for service.

Both Mayor Hylan and G. M. Dahl, chairman of the railway, have commented on the findings.

Brooklyn Company Asks Bus Rights—Zone Fares Suggested

Application was made on Aug. 14 by e Brooklyn-Manhattan Transit Cor- ration to the Mayor and to the Board Estimate and Apportionment of the y of New York for franchises or her legal permits for routes for the eration of buses. Without under- king, at the present time, to specify l of the routes upon which bus opera- n is desirable, application is made r authority to place buses in opera- n over routes in the Kings Highway, ownsville and Richmond Hill sec- ns.

Under the law, the Transit Commis- n will have jurisdiction of such cor- ration in respect to a certificate of cessity as to such matters as capital- ation, accounts, character and safety equipment and operation. The com- ny explains, however, that in order at the city and the public may be rther protected, it is willing to agree at the city shall have access to the oks and accounting of the bus com- ny and absolute veto power on all pital expenditures as well as the veto wer on the issuance of securities or ock by the bus company and the ice at which such securities and ock shall be sold.

It is suggested that the rate of fare one which will pay operating ex- nses, taxes, provide for necessary serves and give a fair return on the pital actually invested. During an perimental period, to be agreed upon, e rate of fare upon the routes sug- sted would be 5 cents.

Chairman Dohl for the company says is willing to discuss with the city thorities the public advantage of a cent fare for short hauls and a gher fare for longer hauls and the tablishment of a scientific zoning stem as well as the possibility of timately providing reduced fare ansfers between bus surface and pid transit facilities.

Safety Measures Considered in Chicago

There will be no more arrests of icago motorists who drive their cars ross Chicago street car tracks at a eed greater than 10 m.p.h. The cor- ration counsel has so ruled. The city dinance under which the arrests had en made was passed some years ago. was intended to safeguard both the iver and the occupants of other hicles from possible injury. The rporation counsel, his attention called a recent ruling of the State Supreme ourt that the right to prescribe speed gulation lies in the state authorities, greed that the ordinance could not be gally enforced.

For the first time in its history Chi- go will try safety loading zones. It as intended to start with them some me during the week ended Aug. 16. oth motor clubs of the city, called into nference with Leo J. Winiecki, direc- r of the public service department, greed that the city's traffic problem ight be helped with the installation of ading zones. Zones 6 ft. wide and ft. long will be painted on the pave- ent alongside the tracks. Parking will be prohibited 25 ft. back of the end of the zone which will be marked by removable standards. It is planned to operate the zones from 7 a.m. until 6.30 p.m. Two zones on Clark Street at Madison and Monroe Streets will be the first ones instituted.

"Go Slow!" Warns Court

Kansas City Jurist Gives Car Riders Some Facts to Ponder—Open Minded on Bus

Judge Kimbrough Stone, in charge of the receivership of the Kansas City Railways, has urged against premature action by the city on the subject of bus operation and has stated that "the court is entirely open minded" on the subject of operation of bus lines by the railway, "but has not the information and has not given the subject sufficient serious thought to reach any conclusion." The subject, however, was held to require careful study and consideration, both from the standpoint of the utility of the bus as an additional transportation agency in Kansas City, and from the position of the creditors of the railway, whose funds would be used if a new bus service under railway direction were instituted.

The court held that operation of an independent bus system in competition with the railway might work so serious an injury to the existing transportation agency that it would permanently cripple railway service in the city.

These ideas by the court were expressed in a letter addressed to the receivers of the railway. Except for the salutation, the letter follows substantially in full:

As to bus operation by other than the railway the court has definite ideas derived from observing the actual effects of a similar form of competition from jitneys. As to operation by the receivers the court is open minded but has not the information and has not given the subject sufficient serious thought to reach any conclusion.

Experience with jitneys in Kansas City has proved that regular operation of well equipped bus lines would result in dangerous loss of patronage and revenue to present street car service—a service made possible only because the wisdom of the city officials has done away with jitneys.

The undoubted greater loss from regular bus lines probably would necessitate abandonment of many lines, unprofitable even now; might, if sufficiently threatening, force the court, to order stoppage of all service.

Some manufacturers of buses get an operating franchise or permit from a city; go into operation; harm the railway and then sell to the railway at a handsome "water" profit.

Right now in St. Louis a company controlled by the same bus manufacturing corporation whose representatives are clamoring to operate in Kansas City is, I am informed, demanding a profit of $1,000,000 or about 80 per cent above actual investment on the bus lines there. This court never will permit the car riders of Kansas City to be victimized through the purchase of a competing bus line.

Whether railways should operate bus lines is a new and difficult problem. The question becomes particularly grave when the answer must be made by this court concerning property of others. Such a step involves:

1. A venture into new fields which have not (so far as this court knows) been thoroughly proved under conditions present in Kansas City (such as topography, density of population, character of paving, traffic congestion, traffic control, etc.)

2. A de luxe service not possible regularly to most street car riders because of the higher fare, or possibly, because of lack of transfer rights. However, it is clear that a combination of the two grades of service may react unfavorably upon the cheaper service, through removal of the richer class of the present street car patrons to buses or in other way.

3. The expenditure of a vast sum of money painstakingly accumulated to pay debts long due from an insolvent property to hundreds of creditors, many of whom are sorely in need of their money.

No self respecting court would determine matters so seriously affecting the property and rights of others and of the public without full information and careful consideration. That information will be collected without undue delay or unseemly haste.

On the presumption that the receivers would desire to make the letter public, the court said:

This court has had four years of intimate association with the railway problem and believes the welfare of the system and the well being of this community are inseparable. The court will do its best to preserve both. It can not, however, say what forms of transportation Kansas City shall select and have. That is the problem of the people of Kansas City and their chosen officials. Upon them must rest the burden of the responsibility of determining whether two competitive transportation systems can survive in Kansas City.

To the correct solution of this problem the court bespeaks the careful, earnest thought and action of every serious minded Kansas Cityan. Unless you are convinced that the street car is no longer necessary, is it not wise to be cautious lest you cripple the only transportation system you have so that it will be unable to serve you except haltingly if at all? It is a matter for genuinely serious pause and thought.

Union Terminal in Los Angeles Will Be Decided by I. C. C.

The long-drawn out battle waged by the city of Los Angeles to force the railroads entering Los Angeles to establish a union depot at the Plaza has practically been closed with the city of Los Angeles on Aug. 5, filing its briefs for a decision by the Interstate Commerce Commission at Washington. The city requests the commission, in its order, to have the Southern Pacific abandon its main-line tracks on Alameda Street for the operation of passenger and freight trains, while a request was made that the Sante Fe line, the Union Pacific system, and the Pacific Electric system abandon certain grade crossings. At the same time, the Southern Pacific, Union Pacific and Pacific Electric joined their cases in one brief and argued for the establishment of a union station at the present arcade depot of the Southern Pacific while the Santa Fe objected to unification.

During the latter part of June the California State Railroad Commission and the city of Los Angeles presented their definite plans for the Plaza union passenger station for the trains of all the roads. The new plan of the commission proposes not to shut off any street nor would it eliminate the plaza from its historic position.

When this matter developed it was based upon the action of the California State Railroad Commission ordering the four rail lines to unify their lines in a joint terminal. The railroads fought the order of the commission and carried the case into the United States Supreme Court. That body ruled that the commission was without jurisdiction in making its order. The city of Los Angeles then carried its fight before the Interstate Commerce Commission.

In its application to the federal rail regulating body, the city asked that the original Plaza plan be ordered executed.

News Notes

New Tariff Filed. — The territory served by the Port Jervis Traction Company, Port Jervis, N. Y., in accordance with a new tariff filed with the Public Service Commission, has been divided into two zones, each with a 5-cent cash fare. This represents a reduction of 3 cents from the former rate. Between any point in Zone 1 and any point in Zone 2 the 8-cent cash fare will remain. Books containing ten tickets will be sold for 75 cents. Such tickets will be accepted for passage between any two points on the company's lines where the cash fare is 8 cents (reduction 5 cents). These tickets will also be good for certain joint transportation in connection with the Port Jervis Transit Company, Inc., a new bus company.

Thomas E. Mitten Safe.—Thomas E. Mitten, chairman of the board of directors of the Philadelphia Rapid Transit Company, Philadelphia, Pa., was not in the automobile accident in the Canadian Rockies in which his brother William E. Mitten was killed. Reports at first had it that the Philadelphia traction official had been killed along with his brother, but Thomas E. Mitten had left the party and was in Seattle at the time of the accident.

Joint Rates Continued. — Continuation of joint freight rates between the Bamberger Electric Railroad, Salt Lake City, and the Denver & Rio Grande Western Railroad has been ordered by the Public Utilities Commission of Utah. The Denver & Rio Grande Western fifteen months ago filed tariffs to cancel joint rates and increase rates on all classes and commodities of freight originating west of the Colorado-Utah line, which was to be shipped over both roads. The Bamberger Electric, which serves the centers of population, opposed discontinuance of the joint rates and acceptance of increased schedules. The commission takes the position that the proper development of the country, and the best interests of the shippers make necessary this continuance of railroad rates.

"Pass" Under Consideration. — The Ottawa Electric Railway, Ottawa, Can., is studying the "weekly pass" plan. The management in a recent issue of *O. E. R. News* stated that it was anxious to try any plan that would make for good service and a satisfied patronage.

Wages Advanced Ten per Cent.—A decision in the case of the employees of the Trenton & Mercer County Traction Corporation, Trenton, N. J., increases the men's wages approximately 10 per cent. The agreement followed a conference attended by James H. Vahey, Boston, Mass., representing the Union; Albert Richey, Worcester Polytechnic Institute, for the company, and Lewis C. Parker, chosen by the other two. The men asked for a 35 per cent boost. The new awards are as follows: An increase of 5 cents an hour retroactive to April 1; a payment of 10 cents to each employee who makes out an accident report; a credit of ten minutes' time to men for making out their daily reports; permission for the company to operate twenty swing runs and to pay not less than nine hours to be worked within fourteen hours. All early and late straight run work over nine and one-half hours to be overtime at time and one-quarter payment.

Plans to Extend D. T. & I. Railroad. —Henry Ford was authorized on Aug. 1 by the Interstate Commerce Commission to construct approximately fifty-six miles of new line for his Detroit, Toledo & Ironton Railroad at a cost of about $7,500,000. The commission also authorized the issuance of first mortgage bonds to raise the funds. The authorization was to the Detroit & Ironton Railroad, a subsidiary corporation, which Mr. Ford organized to build from Malinta, Ohio, to Durban, Mich. The new line will shorten haulage distances over the Detroit, Toledo & Ironton. Mr. Ford's plans looking toward the electrification of the Detroit, Toledo & Ironton have been referred to previously.

Wage Scale Renewed.—Trainmen of the Indiana, Columbus & Eastern Traction Company, Springfield, Ohio, on Aug. 6 signed a contract renewing the present scale and working conditions for another year. The men had previously sought an increase. The wages paid for another year will be 48, 50 and 52 cents an hour.

Hearing Concluded.—A hearing was held recently before the California Railroad Commission on the petition of the city of San Bernardino for a uniform 6-cent fare by the Pacific Electric Railway within the city limits. It is expected that a decision will be made within a month. The city as was referred to previously in the ELECTRIC RAILWAY JOURNAL is seeking to have the present 6-cent fare boundary limit extended from Mill Street to Esperanza. A 9-cent fare is now required on cars south of Mill Street. This is the rate between San Bernardino and Colton.

Tokens in Use on Long Island Line.—The New York & Queens County Railway, New York, N. Y., has begun the sale of tokens for 6 cents. This is the same rate as the cash fare, and the tokens are placed on sale as a convenience to passengers. This railway is the only road in New York City selling tokens.

New Rates Sanctioned.—The Public Service Commission has authorized the International Railway to issue a commutation coupon book good for 25 rides any time during a calendar month between Buffalo and Park Avenue, Tonawanda, at the rate of $2.50 per book. The new fares will be effective Sept. 1.

Buses Will Replace Cars. — The Citizens Traction Company, Oil City, Pa., will suspend railway service between Franklin and Rocky Grove. Bus service will be substituted.

Men Receive Back Pay.—The Worcester Consolidated Street Railway, Worcester, Mass., has just completed distribution of $150,000 in back pay among its employees. This money was due the men from Jan. 1 to the date of the decision of the board of arbitration which granted an increase of 1 cents an hour.

Recommend Service at Cost.—A committee of the Chamber of Commerce that has been studying the problem of making it possible for the electric railway in Tulsa to continue in operation has recommended a trial of the service-at-cost plan. The officials of the local railways state that they will be glad to have the experiment tried on their properties.

Will Operate Two-Man Cars.—Officials of the Springfield Street Railway, Springfield, Mass., have announced that they will comply with the request of the public and operate two-man cars from 5 a.m. to 8:30 a.m., and from 4 p.m. to 7:30 p.m.

"Weekly Pass" May Be Installed.—The San Antonio Public Service Company, San Antonio, Tex., is considering the advisability of the "weekly pass" plan for application on its system. The management believes this arrangement will increase the revenue. San Antonio now has a 6-cent fare with universal transfers.

Will Not Intervene in One-Man Car Protest. — The East St. Louis City Council has decided not to interfere with the plans of the East St. Louis Railway to install one-man cars on the Main Street and Cleveland Avenue divisions. This decision was reached following a conference with Mayor M. M. Stephens, city commissioners and W. H. Sawyer, president of the company. Mayor Stephens called the meeting after he had received a number of petitions protesting against the one-man cars. The City Council decided that it had no power to prevent the company from using one-man cars.

Unnecessary Service Ruled Out.—The Corporation Commission of Oklahoma has refused to permit J. A. McIntyre of Norman to establish a bus line for passenger service between Oklahoma City and Lexington via Moore, Norman and Noble. The commission holds that with the hourly service afforded by the Oklahoma Railway between Oklahoma City and Norman there is no necessity for the motor service and that public convenience would not be served thereby. The applicant was allowed to establish a bus line between Norman and Lexington via Noble.

Difficulties Settled. — Difficulties between the Michigan Electric Railway, Lansing, Mich., and its employees have been temporarily settled. The company has agreed with local Trades and Labor Council to reinstate after thirty days' suspension two bus drivers and 12 street car operators who were dismissed on charges of violating the rules.

Hearings for Buses in Framingham Settled.—Public hearings on the petitions of the Boston & Worcester Street Railway for permission to substitute buses in Framingham, Mass, on its Framingham Center and Saxonville branches will be held before the selectmen on Aug. 19, at the Framingham town rooms and before the state department on Aug. 22 in the State House. More trolley lines are said to enter Framingham than any other community in the state, outside of the larger cities.

Foreign News

Japanese Railway to Electrify

The electrification of the Tokaido railway line between Tokio and Akashi has been approved by the directors of the divisions making up the entire railway system of Japan.

The work under consideration at present consists of the portion of the Tokaido line extending from Numazu to Akashi, a distance of approximately 300 miles. This work, not including the cost of locomotives, is estimated to require the expenditure of about 21,883,000 yen (approximately $10,700,000), made up of the following items:

	Yen
Substations	6,833,000
Overhead construction	13,203,000
Communication equipment	846,000
Train sheds	1,101,000
Total	21,983,000

It has been definitely decided to operate at 1,500 volts direct current, with single catenary overhead construction, fed from approximately twenty-five substations. It is estimated that approximately 80,000 kw. will be required to operate the system, which power will be purchased from private companies for the time being, though ultimately the government railways will construct a hydro-electric plant on the Fenryu River having a capacity of 75,000 kw.

Active construction work will begin early in 1925. The first section should be completed by the end of 1926, and the electrification of the entire Tokaido line is scheduled for completion by the end of 1928.

In addition to the electrification of the Tokaido line, the Railway Department has already prepared tentative plans for electrifying both the Central and the Northern lines.

While the foreign electric locomotives have so far dominated the field, at least one Japanese company is active in competing for this business. A trial locomotive recently completed and tested by the Hidachi Engineering Works in design embodies many features introduced by American manufacturers.

Traffic Project Proposed at Milan

Traffic congestion in Milan has become so serious that a committee was recently appointed to study the problem. A plan has been proposed, and approved by the Prime Minister, to decentralize the trams which terminate in Piazza del Duomo, a magnificent square with eight narrow streets leading into it. Under the new plan the trams would terminate at the Naviglio, a canal encircling the city about a mile out, and electric cars of the American light car type would carry passengers from the canal through the square to a destination on the further side of town. The type of car contemplated for inter-city service is a one-man storage-battery auto bus having a carrying capacity of forty to fifty passengers. This would mean economical operation and permit the cars to keep to the left, thus allowing two streams of traffic. It is expected that 150 new trams will be put into service soon to replace old running stock and also increase efficiency of service.

Extension of Paris Subway Is Planned

A project for the extension of the Paris Metropolitan Underground Railway to the suburbs at the east and south of the French capital is under consideration by the Paris Municipal Council. The first line it is proposed to extend will be that from the Bastille to Vincennes and that from the Luxembourg Gardens to Sceaux, making use of the present steam-operated surface railway line. The inner belt line railway, which joins the principal railroad stations in the capital, will for the time being be left out of the plan. The first problem to be decided is that of financing. Two committees working together, representing the Paris municipality and the government Ministry of Public Works, will formulate plans, through which the project may best be carried out.

Substantial Amount Invested in Barcelona Property

At a meeting of the holders of the 6 per cent first mortgage bonds of the Barcelona Traction, Light & Power Company, Barcelona, Spain, held recently in London, E. R. Peacock, speaking as president of the company, reviewed briefly the history of some of the important events in the development of the companies there. He said that since 1915 a substantial amount had been invested in the business of the operating companies, mainly from sale of securities of these companies.

In addition more than £2,500,000 had been put into the business out of earnings. It had been the policy of the company to keep the equipment in a high state of efficiency as part of the operating expenses but that any great operating company must year by year put back into the business a substantial portion of its earnings if it is to continue to grow and prosper. And further that it must confine its increases of capital to those required for the large developments which are called for only at long intervals. At the meeting resolutions were passed approving the proposal for the readjustment of the finances of the property. When the reorganization is completed the company, in the opinion of Mr. Peacock, will be in a sound position.

As originally contemplated the plan provided for the issuance of £2,000,000 of new consolidated 6½ per cent bonds to purchase and cancel £260,000 of prior lien bonds and for the redemption of the outstanding balance of £1,100,000 of 8 per cent debentures at 106.

One-Man Cars Operated in London Suburbs

The experiments carried out by the London United Tramways with a single-deck one-man car have been so encouraging that the company is now constructing others of the same type which will incorporate further improvements. The driver will be provided with a seat and he will control the car from an inclosed platform.

The car embodies many features of the one-man cars used in the United States, having doors with folding steps and interlocked control.

New Tramway in England

The Dearne District Light Railway of York, England, was formally opened for traffic on July 10. The company was organized over ten years ago, but was held up on account of the war. It is one of the few new tramway undertakings inaugurated in England in recent years. The line is 13 miles long and connects a number of mining towns and villages. As a precaution against decreased revenue, should mining operations cease, a special form of track construction was used at a cost of about £6,500 per mile of single track. Thirty single-deck thirty-six-passenger cars are employed.

Station Reconstruction Speeds Traffic

An increase of 500,000 passengers per annum is the result of the modernizing of Westminster Station of the Metropolitan District Railway. This station is now one of the most up-to-date of all the London underground stations as regards handling of traffic. The large circulating area, widened staircases and electric automatic passimeter ticket-issuing equipment have greatly facilitated the movement of traffic. The passenger inserts the correct fare in the ticket machine. This issues his ticket, dated and cancelled, releases the turnstile, registers him on a recorder and locks the turnstile after he has passed through.

New Railway Under Consideration.—N. B. Seblich, an electrical engineer of Berlin, is making an investigation of the traffic possibilities of an interurban electric railway to run from Mexico City to Cuernavaca, 75 miles. He represents Swiss financial interests, according to his statement. Power for operating the proposed line will probably be obtained from the plant of the Mexico Power & Light Company at Necaxa. Cuernavaca was the most popular tourist and week-end resort in Mexico in pre-revolutionary days.

Motor and Trolley Buses Denied in Croydon.—A committee of the House of Commons has denied the application of Croydon Town Council to run trolley buses and motor buses in connection with its tramways. Frank Pick, assistant managing director London General Omnibus Company, opposed the application, stating that it was the ambition of his company to be the sole provider of bus traffic in the metropolitan area and that wasteful competition should be eliminated.

Financial and Corporate

Good Year for Illinois Power & Light Corporation

The income from the properties of the Illinois Power & Light Corporation, Chicago, Ill., in 1923 showed a substantial increase over previous years. While the gross earnings were $27,930,854, an increase of 11.4 per cent over the year 1922, the net earnings were $9,119,047, or 24.6 per cent more than in 1922, the largest previous year. This is the first report of the company since the properties were merged, on May 25, 1923, into the Illinois Power & Light Corporation. The opinion is expressed by Clement Studebaker, Jr., president, that the consolidation of the properties formerly comprising the Illinois Traction System and the Southern Illinois Light & Power Company has proved in every way advantageous to the territories served, to the bondholders and stockholders and to the properties themselves.

DISPOSITION OF NET EARNINGS OF ILLINOIS POWER & LIGHT CORPORATION

Total net earnings		$9,119,047
Less fixed charges:		
Interest charges, etc.	$4,135,583	
Bond discount amortized	220,713	4,356,296
Surplus available for depreciation and dividends		$4,762,751
Dividend on preferred stocks, Illinois Power & Light Corporation and subsidiary companies		1,358,330
		$3,404,421
Appropriated for depreciation, in accordance with terms of trust indenture		761,943
Balance available for common stock dividends, etc		$2,642,478
Dividend paid on common stock, $1 per share		400,000
		$2,242,478
Additional appropriation for depreciation		1,238,057
		$1,004,421
Adjustment of prior year's dividends from subsidiary companies		30,536
Balance, Dec. 31, 1923		$1,034,957

It is explained that since the formation of the new company the officers and engineers have been intensively studying its physical needs with a view to creating and maintaining the highest type of service in its various communities. This involves the consolidation of sources of power supply and the installation of the latest production and distribution methods and modern equipment. In consequence in addition to minor power plant and transmission line developments, many changes of first magnitude are contemplated. These extend to new and enlarged power houses, construction of new transmission lines and improvements to the railroad department. Thus the power supply of the railroad between St. Louis and Springfield will be increased. Specifically listed among this work are six new electric locomotives, 100 new box cars and seventeen new one-man interurban cars. It is also stated that provision has been made for the purchase of motor coaches and for the adoption of present rolling stock equipment to one-man operation so as to permit more frequent and efficient service.

For the purpose of tying the company's operations more closely to the communities served, an intensive sale of its preferred stock to customers has been carried on by the investment department. More than $3,000,000 of this stock was disposed of in a few months to the public and employees, with the result that at the time of the annual meeting last April there were 7,390 preferred stockholders.

Deferred Payment Plan Explained

Frank L. Dame, president of the North American Company, New York, N. Y., has announced the purposes of the "deferred payment" plan, in connection with the offering to the stockholders of an opportunity to purchase, subject to allotment, $10,000,000 aggregate par value of the company's preferred stock. He said that one purpose was to provide additional capital for the requirements of the company; another purpose is to afford to the stockholders a means of purchasing on deferred payments, a high-grade security, and a third reason is to give to the stockholders the full benefit of the present low money rates, by procuring for them a 4 per cent interest rate per annum on their deferred payments. The essential features of the "deferred payment" plan are the requirement of subscribers on or before Aug. 15, 1924, to make an initial payment of $20 per share of stock subscribed for, the remaining $30 of the purchase price being payable in three instalments of $10 each on Jan. 2, 1925, or April 1, and July 1, 1925. Stock certificates to be delivered to the subscribers upo completion of payments on the spec fied dates will in each instance carr all dividends paid on the preferre stock after the date of completion o payments.

COMPARATIVE STATEMENT OF EARNINGS OF COMPANIES CONSTITUTING ILLINOIS POWER & LIGHT CORPORATION

	1919	1920	1921	1922	1923
Gross earnings from operations:					
Electric light and power	$6,471,155	$7,891,608	$9,209,945	$10,442,752	$12,400,998
Gas	1,122,384	1,302,671	1,623,829	2,195,048	2,722,533
Interurban lines	5,930,525	7,175,663	7,161,772	6,939,641	6,676,610
City lines	4,036,349	4,714,116	4,596,796	4,506,913	5,178,391
Heat	513,799	557,246	527,454	574,258	620,363
Water	68,645	71,926	77,872	90,415	100,190
Miscellaneous	249,721	381,140	302,215	315,584	231,769
Total gross earnings	$18,392,578	$22,094,370	$23,499,883	$25,064,611	$27,930,854
Operating expenses, maintenance and taxes	13,257,580	16,352,776	17,066,428	17,746,168	18,811,807
Net from operating	$5,134,998	$5,741,594	$6,433,454	$7,318,443	$9,119,047

Hearings on Property Valuation in Twin Cities Concluded

In the hearing before the Minnesot Railroad and Warehouse Commission t set a permanent rate of fare in th Twin Cities testimony has been con cluded as to property valuations of th St. Paul City Railway and the Min neapolis Street Railway. Hearings o the operating expenses of the Min neapolis Street Railway have been held and in the case of the St. Paul City Railway the similar hearing was set to begin on Aug. 13.

It was predicted by Comptroller D. J. Strouse for the Minneapolis company that revenues for 1924 would fall $1,000,000 from the $8,504,294 total for 1923. He placed the probable total at $7,611,922.

On the property valuation of the companies several bankers testified for the company. Those who appeared included E. W. Decker, president of the Northwestern National Bank; R. W. Martin, of Dillon, Read & Company, New York; L. E. Wakefield, vice-president of the Wells-Dickey Trust Company; R. W. Webb, president of the Minneapolis Trust Company and W. B. Baird, vice-president of the Merchants Trust Company, St. Paul.

In effect this testimony went to show that traction securities are not so favorably regarded among investors as are other utility investments. Mr. Decker said the rate of return of the properties of the railway companies should be at least double the average rate of interest on the bonds issued by the companies.

Traffic on Increase in East Bay Cities

Electric railway traffic in the East Bay cities of California is increasing. The Key System Transit Company, Oakland, shows a gain of 1,614,238 in the number of passengers carried for the first six months of this year compared with the similar period last year. The semi-annual report shows the following:

Passengers Carried	1924	1923
Traction Division:		
Revenue passengers	38,512,998	37,869,303
Transfer passengers	10,435,625	10,084,985
Total traction division	48,948,623	47,954,288
Key Division:		
Revenue passengers	8,879,086	8,259,243
Entire System:		
Revenue passengers	47,392,084	46,128,546
Revenue and transfer passengers	57,827,709	56,213,531

Normal increase in population, given as the principal reason for this gain, does not tell the whole story. It is said that auto-parking conditions in the bay cities have driven many autoists back to the street cars. There is a forty-minute limit on parking in Oakland, but it has been found impossible properly to enforce this. As a result the business section is congested on week days with parked cars.

Interurban Doing Well

Management of Kansas City, Clay County & St. Joseph Line Alive to Changing Conditions

The operations of the Kansas City, Clay County, & St. Joseph Railway, Kansas City, Mo., for the year ended Dec. 31, 1923, show an increase in both gross and net income. The passenger revenue was $1,026,706, a net increase of $4,887 over 1922. Of this amount $15,304 was an increase on the Excelsior Springs Division and $10,416 a decrease on the St. Joseph Division. The number of passengers carried was 2,353,224. This is a net increase of 100,115, of which 125,807 was an increase on the Excelsior Springs Division and 25,692 a decrease on the St. Joseph Division. The complete line comprises 72 miles of track.

R. P. Woods, vice-president and general manager, explains that the year 1923 was an abnormal one for the farming industry and that on account of the depression both the through and the local business on the St. Joseph Division fell off materially since much of the business on this part of the road is made up of patronage incident to the farming industry. On the other hand business on the Excelsior Springs Division was low because the highways leading into the Springs were practically cut off during the entire year owing to highway rebuilding work. This made the business in Excelsior Springs the poorest which has been experienced there in many years. It is expected, however, that the completion of the hard surface roads will make business in Excelsior Springs this year a banner one.

Mr. Woods explains that extensive repairs to equipment were made during the year. Two-thirds of the passenger equipment was completely overhauled and repainted with the result that the equipment is in splendid condition so that if it should become necessary to make radical reductions in operating expenses the equipment account could be materially reduced without serious difficulty.

The pamphlet report of the company is a most complete and unusual one. Included in the statistics reproduced herewith are earnings from freight which cover the years 1915 to 1923. This is a most interesting comparison. Moreover, the tenor of the report indicates that the management is thoroughly alive to the need for the intensive cultivation of the riding habit and that it is going after business, both freight and passenger, intensively. Just as an instance, the trainmaster's entire time is spent riding the trains, seeing that all rules of the company are enforced, and that the equipment is properly handled. This official keeps in close touch with the dispatcher and advises him when necessary to add additional cars to any train on account of extra travel from any point.

Bus Line Sale Price Considered Too High

The plan to purchase the bus lines in St. Louis in the interest of the successor to the United Railways fell through when the committee representing the bondholders of the St. Louis Transit Company declined to advance the money needed to swing the deal. The Transit bondholders are understood to have held that the price asked was too high, especially when the bus company was operating merely on revocable permits issued by the Board of Public Service.

Col. Perkins, general manager for the receiver of the United Raliways, in his address in opposition to the proposed new bus lines, charged that although the Missouri Public Service Commission, in its valuation of the properties of the United Railways had not allowed anything for franchises the purchase of the bus lines for $2,400,000 would have placed a franchise value of more than $1,000,000 on the bus permits granted by the city.

He stated that if the new bus lines are opened the railway will have to increase its fare, curtail service and reduce the number of employees or cut the wages of all its workers. He also stated that the policy of granting permits for bus lines to compete with the existing railway had already made it difficult to obtain capital needed to reorganize the railway and lift the receivership.

W. Frank Carter, counsel for the bus company, denied that the price asked for the bus lines was exorbitant. He said that the company had already invested $1,400,000 in the system and had $700,000 in bank for additional buses, garages, etc. He said that the company planned to employ 800 men eventually and that this would more than offset any employees the railway might lay off because of bus competition.

Earnings in Atlanta Show Appreciable Decrease

Railway earnings of the Georgia Railway & Power Company, Atlanta, Ga., showed a decrease for July, 1924, compared with July, 1923, of $38,779 or a drop of nearly $1,300 a day. Out of the twenty-four city car lines operated by the company, nineteen showed substantial decreases for the same month, and July, 1923, the company states, was a month far below normal.

The reason for this drop in earnings is attributed by the company "to the in-

OPERATING DATA OF THE KANSAS CITY, CLAY COUNTY & ST. JOSEPH RAILWAY

Comparative Income Statement

	1923	1922
Railway operating revenue:		
Railway transportation, St. Joseph division	$755,191	$772,841
Excelsior Springs division	466,525	425,652
	$1,221,716	$1,198,493
Other railway operations, St. Joseph division	6,333	9,498
Excelsior Springs division	6,991	4,299
	13,325	13,797
Total operating revenue	$1,235,041	$1,212,291
Railway operating expense:		
Way and structures	$107,071	$101,987
Equipment	85,695	68,533
Power	107,715	136,177
Conducting transportation	228,032	223,924
Traffic	7,966	6,856
General and miscellaneous	157,354	154,882
Depreciation	100,060	100,004
Taxes (not including federal income tax)	29,094	30,396
	$845,087	$822,759
Net railway operating income	$389,954	$389,531
Net operating income:		
Interest from funded securities	2,490	2,677
Interest from unfunded securities	4,039	2,701
Interest from sinking fund	1,509	486
	$8,038	$5,865
	$397,992	$395,397
Deductions from gross income:		
Interest on funded debt	161,450	161,304
Gross income	$236,542	$234,093
Less estimated federal income tax	24,892	20,262
Balance available for surplus and dividends	$211,649	$213,830

* The auditors have taken the accrued depreciation, less expenditures for renewals and replacements, $79,926 as an appropriation of surplus. Add that amount to check their surplus net income of $291,576.

Summary of Comparative Operating Expense†

Operating Expenses	1923	1922	Cost per Car Mile (Cents) 1923	1922
Way and structures	$183,277	$178,181	9.87	10.23
Equipment	101,783	84,575	5.45	4.85
Power	137,578	143,942	7.41	8.26
Conducting transportation	228,032	223,924	12.28	12.85
Traffic	7,966	6,856	0.43	0.39
General and miscellaneous	157,356	154,884	8.47	8.89
	$816,992	$792,362	43.97	45.47

† Not including taxes.

Operating Statistics

	1923 Total	Average per Day	Average per Car-Mile (Cents)	Average per Track Mile
Operating revenue	$1,235,041	$3,383	66.51	$15,521
Passenger revenue	1,013,244	2,776	64.41	12,734
Freight revenue	194,988	534	84.07	2,450
Operating expenses	815,992	2,235	43.94	10,255
Car-miles (passenger)	1,572,912	4,309		
Car-miles (freight)	231,921	635		
Car-miles (service)	52,030	142		
Revenue passengers	2,322,817	6,391	1.26	Average Fare 43.62
			Kw.-Hr.	Cost per Kw.-Hr.
Power, kilowatt-hours	7,559,720	20,711	4.07	1.527
Car-hours (passenger)	84,423	231		
Car-hours (freight)	13,018	36		
Passenger trains, regular	.....	88		
Freight tonnage	96,351	269		

Freight Statistics

Year	Gross Revenue	Gross Tons	Less Carload Revenue	Carloade Revenu
1915	$59,554	19,970	$54,419	$5,135
1916	69,723	24,177	64,007	5,716
1917	82,676	28,828	74,472	8,204
1918	98,682	37,464	88,024	10,657
1919	112,955	38,327	103,606	9,349
1920	158,252	40,945	148,942	9,303
1921	172,254	36,900	159,520	12,733
1922	176,248	43,180	156,258	19,989
1923	194,988	96,352	148,146	46,842

crease in unregulated jitneys" and, it is added if the loss continues, it will result in "the inevitable disruption of Atlanta's transportation system." The statement then says:

> The railway last year failed by more than $565,000 to earn a reasonable return on the Public Service Commission's minimum valuation of the property. It cannot continue to bear the burden of such losses.
>
> The facts about the transportation situation are being put before the people of Atlanta in the expectation that, in their own interests, they will see that the alarming condition is speedily remedied.

Directors Vote Stock Dividend in Brooklyn.—Through an increase in its capital stock from $12,000,000 to $16,000,000, authorized previously by the Transit Commission, the Brooklyn City Railroad directors on Aug. 13 declared a stock dividend of 33⅓ per cent, or $4,000,000. The dividend is payable Sept. 30 to stockholders of record Sept. 5. The regular quarterly dividend of 25 cents a share, payable Sept. 2 to stockholders of record Aug. 16, also was declared. The company's letter to its stockholders last February pointed out that since October, 1919, when the properties formerly leased to the Brooklyn Heights Railroad were returned, the company withheld dividends and spent more than $4,000,000 out of earnings to increase its facilities.

Union of Properties Viewed With Interest.—Barrons, New York, states that it is reported the Piedmont & Northern Railway, a prosperous electrified railroad in the cotton mill belt of the Carolinas controlled by James B. Duke and his associates, is to be united, both physically and financially, with the now bankrupt Georgia & Florida. In commenting on the report that paper says that if this trade goes through, railroad men will watch the result with interest, for James B. Duke has made a success of every enterprise he has undertaken, whether in tobacco, fertilizer, power, textiles or railroads.

Option Sought on Interurban Shares.—A report is current in Indianapolis that members of the firm of Ball Brothers, glass jar manufacturers, of Muncie, Ind., are seeking a six-months' option on 1,000,000 shares of common and an equal number of shares of second preferred stock of the Union Traction Company, Anderson, Ind. Officials of the railway said that acquisition of the stock, if that was accomplished, would not change the present ownership status of the company, as members of the Ball Brothers firm as stockholders had always taken an active interest in the company's affairs. Edmund F. Ball, a member of the Ball Brothers firm, is a director in the traction company.

Mortgage for Jersey Merger Filed.—The Public Service Gas & Electric Company of New Jersey filed a mortgage for $31,834,000 to the Fidelity Union Trust Company, Newark, recently as part of the refinancing plan of the corporation, made possible by the merger two months ago of the Public Service Gas Company, the Public Service Electric Company and the United Electric Company of New Jersey. The mortgage will secure an issue of bonds bearing 5½ per cent interest and maturing in 1959.

Fort Wayne & Northwestern Deal Approved.—The Public Service Commission of Indiana has authorized the Indiana Service Corporation to buy 95 per cent of the outstanding capital stock of the Fort Wayne & Northwestern Railway, which operates 41.75 miles of interurban line between Fort Wayne and Garrett, with branches to Kendallville and Waterloo. The sale price will be $472,200. The corporation will issue $661,760 of 5 per cent bonds at 82 per cent of par. It will assume $355,000 of outstanding bonds of the company at an agreed price of $328,375. The Indiana Service Corporation will have to pay $800,575 and assume liability for the bonds outstanding. At 82 per cent of par the $661,760 face value of bonds will yield $542,643. The difference between this sum and the total cost, or $257,932 will be paid in cash secured from other sources.

Six Months' Operation Results in Deficit.—The Worcester Consolidated Street Railway, Worcester, Mass., carried 22,803,031 revenue passengers the first six months of this year, compared to 25,139,474 for a similar period in 1923. The operating revenue for the same period was $2,135,528 compared with $2,366,923 for the same period of last year. A deficit of $1,501 was reported for the period.

Meeting to Consider Stock Increase.—A special meeting of the Savannah Electric & Power Company, operating in Savannah, Ga., has been called for Aug. 29 to vote on an increase in stock by $500,000. The increased stock is to be made first preferred or debenture stock designated as series "B," in all respects the same as series "A" stock of this class now outstanding except as to dividend rate and redemption price. Directors recommend that the dividend be 7½ per cent, against 8 per cent being paid on the series "A" stock.

Surplus for Six Months.—For the six-month period ended June 30, 1924, the Eastern Massachusetts Street Railway, Boston, Mass., reports operating revenues of $4,998,720 against $5,533,499 for a similar period a year ago. Operating expenses were $4,355,957 in the first six months of 1923 and $3,901,358 for the period from January-June of 1924. After payment of interest charges and dividends the surplus this year was $95,210 against a deficit of $52,012 for a similar period in 1923.

1925 Budget Lower.—The City Council has tentatively allowed the Seattle Municipal Railway Department $6,354,000 for 1925, in making out the 1925 budget allowances. This is a reduction of approximately $420,000 over the allowance for 1924. The budget committee cut $31,000 from the estimate of D. W. Henderson, general superintendent. Of this amount $25,000 was a power item. The committee based this reduction on the expectation that the city will furnish an increased amount of power for the line during 1925. Mr. Henderson advised the committee that the revenues of the system for the first six months of this year were $3,047,958. He believes they will be more than $6,000,000 for the year. There have been fewer car riders, he said, month for month, than last year, but by the end of the year, the average will be about the same. The 192 revenue was less than $5,000,000, bu Mr. Henderson said the 5-cent fare wa partly responsible.

Abandonment Approved.—Abandonment and dismantling of the line of the Aurora, Elgin & Fox River Electric Company, Aurora, Ill., between Fox River park and Yorkville was authorized by the Illinois Commerce Commission on Aug. 6. At the same time the commission issued a certificate to the company to operate buses between Yorkville and Aurora.

Purchase Will Go Before Voters.—Members of the City Council of Seattle, Wash., state that the proposal to buy the Seattle & Rainier Valley Railway for operation in connection with the city-owned system will probably be submitted to the voters, if negotiations to purchase the lines are successful.

Purchases St. Cloud Property.—H. M. Byllesby & Company announced recently its purchase of the St. Cloud Public Service Company and subsidiary companies, which operate electric light and power, gas and railway properties in St. Cloud and supply electric power and light services for fifty-three other communities in Central Minnesota. It is planned to operate the properties as a division of the Northern States Power system. The railway system comprises 8 miles of line.

Stock Issue Petition Heard.—The Indiana Public Service Commission has heard the petition of the Southern Indiana Gas & Electric Company, Evansville, Ind., for permission to issue $500,000 of 7 per cent preferred stock at par. Officers of the company said they planned to sell most of the stock to the customers of the company. They said the company was carrying out a program of extensions and improvements costing approximately $1,454,000. Securities totaling $415,000 as a part of this program, were issued by the company with the consent of the commission the first of the year.

Seeks Abandonment of Certain Lines.—The Newport News & Hampton Railway Gas & Electric Company, Hampton, Va., has petitioned the State Corporation Commission for permission to abandon certain lines in Hampton and Elizabeth City and to be relieved of the obligation of paving and repairing between tracks.

Prices for Substations to Be Announced.—Prices and terms on which the city of Seattle may acquire the railway substations in the city, still owned by the Puget Sound Power & Light Company, will probably be announced shortly. A board of appraisers has been appointed to set the terms upon which the five substations may be purchased. The stations must be acquired by the city before energy to be produced by the municipality at Skagit can be utilized in place of the current that the city, meanwhile, is purchasing under contract.

Line Resumes Service.—The Plymouth & Brockton Street Railway, Plymouth, Mass., which discontinued through service on July 6, has been reopened. The company has filed with the Massachusetts Department of Public Utilities a new tariff, revising the

fare limits. Special provisions are made for working trips, with little or no increase in the rate of fare.

Protective Committee at Work.—A committee has been appointed to dispose of or liquidate the property of the Cleveland & Chagrin Falls Railway and the Cleveland & Eastern Traction Company, both operated by the same management in Cleveland, Ohio. The committee has entered into an agreement with the Guardian Savings & Trust Company, Cleveland, for the deposit of the first mortgage bonds on the property. No plan has yet been announced by the committee as to the best method of operation.

Bond Issue for Houston Line Sold.—It is announced by Ed Kennedy, promoter of the Houston, Beaumont & Orange Interurban Railway, Houston, Tex., that a bond issue of $5,000,000 with which to construct the proposed line has been sold to S. P. Thayer & Son, Washington, D. C. He said that the contract for building the road has been awarded to the J. D. Davis Construction Company, Atlanta, Ga. The contract stipulates that the line shall be completed in fifteen months, dating from July 20. Deeds to 82 miles of right-of-way have been obtained, leaving only 7 miles of right-of-way still to be acquired.

File Suits.—The Dayton, Springfield & Xenia Southern Railway, the Oakwood Street Railway and the City Railway, all operating in Dayton, Ohio, have brought suit in the federal court to prevent M. L. Beard, treasurer of Montgomery County, from collecting more than 60 per cent of their 1923 taxes. The suits charge that the holdings of utilities are assessed at 100 per cent of their value, while in both Greene and Montgomery Counties other property is assessed at 60 per cent of its value. This is declared to be discriminatory.

Funds Deposited to Pay Interest.—Holders of the first mortgage 4 per cent bonds of the United Railways, St. Louis, Mo., were recently notified that funds are on deposit with the Bankers Trust Company, New York, and the Union Trust Company, St. Louis, to pay the interest that is due on the bonds plus six months interest on that sum, totaling in all $624,000. Interest on the $30,300,000 of general mortgage 4s. due Jan. 1, 1924, was not paid. The mortgage carried a provision providing a period of grace of six months before foreclosure proceedings could be instituted.

Tit for Tat in Denver.—The Denver Tramway has presented the city of Denver, Col., with a bill for $67,000, for the cost of moving its tracks from the old Sixteenth Street viaduct, stating that the former Mayor agreed that the city would pay for this work. The city presents the tramway with a bill for $125,000, the tramway's portion for the construction of the new viaduct, saying that such was the agreement between the company and the former mayor. The company says it made no such agreement. The tramway owes the city $210,000 for back franchise taxes. The tramway answers that if the city will deduct the $67,000 it owes the tramway, the money will be paid.

Personal Items

H. A. Mitchell Heads Californians

Interurban Executive Has Been Elected President of the California Electric Railway Association

H. A. Mitchell, vice-president and general manager of the San Francisco-Sacramento Railroad, was elected president of the California Electric Railway Association at the annual meeting of that organization held in San Francisco on July 7. He is one of the best known and youngest electric railway executives on the Pacific Coast.

Mr. Mitchell was born in San Francisco and was educated in the public schools of his native city. His first employment was with the forces of the Pacific Gas & Electric Company as an office boy. This was in February, 1898. Among the properties of that company is the electric railway system in Sacramento. Mr. Mitchell remained with this concern until August, 1906, when he entered the employ of the Fleishhacker interests. They control the Reno Traction Company, in Reno, Nev., and the Central Traction Company, operating between Stockton and Sacramento, Cal. Here he remained in various capacities until Jan. 1, 1913. At the time he resigned Mr. Mitchell was general manager of the Central Traction Company and the Reno Traction Company. On Jan. 1, 1913, he entered on his present duties with the San Francisco-Sacramento Railroad, known as the Sacramento Short Line.

H. A. Mitchell

Mr. Mitchell is also president of the Pacific Railway Club, which has for its object the advancement of the science of railroading and the best interests of the railroad profession and which aims to bring into closer relationship the men employed in various branches of railroad work on all Pacific Coast roads. He is a resident of Oakland and his headquarters are located in the San Francisco-Sacramento Railroad terminal at Fortieth Street and Shafter Avenue in Oakland.

George L. Maltby Resigns

George L. Maltby, for the past fifteen years superintendent of the Jamestown Street Railway, the Jamestown, Westfield & Northwestern Railroad and the Chautauqua Traction Company, all of Jamestown, N. Y., as well as the city bus lines of the first-named company, has tendered his resignation, effective at once. He has organized the George L. Maltby Motor Car Company in Jamestown and will erect a modern service station for Pierce-Arrow motor cars, trucks and buses. Before Mr. Maltby's association with the utility properties in Jamestown, he was city passenger agent and local representative of the freight department of the New York Central lines. During his many years in the railroad and traction business he has established a wide acquaintance, not only in Jamestown but throughout Chatauqua County. A successor to Mr. Maltby at Jamestown has not yet been announced.

Bert Penoyer, maintenance of way engineer of the Schenectady Railway, Schenectady, N. Y., has resigned to become connected with the Kellam & Shaffer Company, Inc., dealers in stone and masons' supplies. His resignation took effect on Aug. 15 and on Sept. 15 he will take up his new duties. After ten years of varied business life, Mr. Penoyer entered the employ of the Schenectady Railway in 1902. Four years later he was made engineer maintenance of way, which position he has occupied since. In announcing the resignation, E. M. Walker, president, said that it was with sincere regret that he was releasing Mr. Penoyer. "Mr. Penoyer has grown up with the company," he added, "and it is only because we believe that his personal interests will be advanced by his new business connection that we considered his resignation at all."

Richard E. Weber, assistant maintenance of way engineer of the Schenectady Railway, Schenectady, N. Y., has been appointed maintenance of way engineer to succeed Bert Penoyer, resigned. Mr. Weber, has been assistant in the department, for two and a half years and is conversant with the duties of the position. He went to Schenectady from Rochester. Mr. Weber is a graduate of Cornell University.

R. J. Smith, vice-president and general manager of the Tri-City Railway, Davenport, Ia., will take over as additional duties the work formerly performed by Clark G. Anderson, vice-president and general manager of the Clinton, Davenport & Muscatine Railway. Mr. Anderson's resignation from the Moline property was referred to in the ELECTRIC RAILWAY JOURNAL, issue of Aug 9.

Manufactures and the Markets

News of and for Manufacturers—Market and Trade Conditions
A Department Open to Railways and Manufacturers
for Discussion of Manufacturing and Sales Matters

More Electric Equipment Exported

During the fiscal year ended June 30, 1924, the number of electric locomotives exported from the United States was seventy-four, an increase of twenty-six over the year before. The value of these exports, however, was only $1,955,646 this year compared with $2,758,191 for the year ending June 30, 1923. Electric passenger cars exported during the 1924 fiscal year numbered 89 with a value of $683,491—an increase of only five in number but of $326,009 in value over the year before.

Recent Arrivals

Since publishing in the July 19 issue of the ELECTRIC RAILWAY JOURNAL the list of companies seeking space allotment for the exhibit at the annual convention of the American Electric Railway Association, to be held in Atlantic City, next October, orders for space have been received from 18 companies. They are as follows:

Robert Bosch Magneto Company.
Brockway Corporation.
The Bassick Manufacturing Company.
The C. G. Spring & Bumper Company.
B. J. Carney & Company.
Clark Equipment Company.
Farnham Nelson Company.
Hoe Corporation.
The Indianapolis Switch & Frog Company.
Janney, Steinmetz & Company.
Magnetic Signal Company.
Princeton Tire & Rubber Company.
Public Service Railway Company.
The Railway Materials Company.
E. J. Thompson Company.
Waynesboro Nut Lock Company.
Wilson-Imperial Company.
P. W. Wood.

$1,000,000 Bonus Payments Made by General Electric

The General Electric Company, Schenectady, N. Y., on Aug. 4 paid to those of its employees who have been with the company continually for five years or more, more than $1,000,000 in supplementary compensation. The bonus payments are for the six months ended June 30 last, and amount to 5 per cent of the earnings of the employees during that period. A total of 27,412 employees shared in this distribution, which was paid largely in bonds of the G-E Employees' Securities Corporation. The total amount paid was approximately $1,172,000.

Pressed Steel Car Company Passes Dividends

The Pressed Steel Car Company, New York, N. Y., omitted its regular quarterly dividend of $1.75 on its preferred stock and $1 on its common stock on Aug. 5, both of which were due at this time. Business for the year has been below normal, F. N. Hoffstot, president of the company, said, but added that he expected net earnings for the year would be sufficient to enable the board to resume payment of dividends on both the preferred stock and common stock at the end of the fiscal year. Action on the preferred was deferred at the suggestion of the company's counsel, who advised the directors that dividends for any fiscal year should only be paid from the earnings after the same had been determined at the end of that year.

Treatment of Timber Fellowship Founded

E. R. Weidlein, director of the Mellon Institute of Industrial Research of the University of Pittsburgh, has announced the founding of an industrial fellowship on the treatment of timber. This research, which is being sustained by the Grasselli Chemical Company of Cleveland, Ohio, and is being conducted by Dr. A. M. Howald, has for its purpose a study toward the improvement of the methods of applying zinc chloride in the wood-preservation industry. Investigational work which was begun during 1923 will be continued throughout the present year. An experimental wood-impregnating plant is maintained for practical tests of processes. Research is being done to increase the permanence of zinc chloride treatments of timber by the addition of petroleum oils.

Rolling Stock

Municipal Railway of St. Petersburg, Fla., has purchased fifteen new cars at a cost of $132,700. The order was placed with J. G. Brill Company. The cars are of the one-man type and seven will be double truck.

Seattle Municipal Railway, Seattle, Wash., has announced that the date for opening bids for furnishing from 75 to 125 cars has been indefinitely postponed by order of the Board of Public Works. The original date was set for Aug. 15.

Massachusetts Northeastern Railway, Haverhill, Mass., has recently placed in service on its eastern division with headquarters at Amesbury ten new light-weight double-truck, one-man safety cars. These cars were built by the Wason Manufacturing Company, Springfield, Mass., and are similar in general design to other light-weight cars manufactured by the same carbuilder.

Union Traction Company of Indiana, Anderson, Ind., has contracted for fifteen all-steel interurban passenger cars. The new equipment is being purchased as part of a program of additions and betterment planned for this year aggregating about $750,000. The company has financed the improvements.

Track and Line

British Columbia Electric Railway, Vancouver, B. C., is repaving on Main Street at a cost of $50,000.

Key System Transit Company, Oakland, Cal., has started work on the extension from the Piedmont Avenue line, along the right of way to Oakland Avenue, the terminus of the line in the city of Piedmont. The work is in compliance with the recent decision of the State Railroad Commission authorizing the Key System to operate a train and ferry service into the city of Piedmont from San Francisco.

Worcester Consolidated Street Railway, Worcester, Mass., has been authorized by the Massachusetts State Department of Public Utilities to extend its tracks on Burncoat Street.

Harrisburg Railways, Harrisburg, Pa., will start work on relaying track in State Street, to be followed by the double-tracking of Second Street, above Schuylkill Street. Both of these operations are preliminary to the paving construction to be begun by the city in these streets, and are undertaken at this time to avoid paving cuts later.

Tri-City Railway, Davenport, Iowa, has completed work of laying new track on West Third Street between Warren and Fillmore Streets in Davenport. The cost was approximately $40,000. The double track has been replaced in accordance with the agreement with the City of Davenport at the time when the rerouting plan was approved.

Des Moines City Railway, Des Moines, Iowa, has started work on the extension of the Clark Street line and expects service will begin Sept. 1. Workmen began to set poles and string the high-tension wires for the line. A portion of the line will be double tracked. The cost of the project is estimated at $40,000.

Illinois Power Company, Springfield, Ill., will soon undertake the Fifth Street project laying new double rails and new pavement between Washington and Monroe Streets.

Indiana Service Corporation, Fort Wayne, Ind., has sent out calls for bids for the erection of a complete block signal system on the Fort Wayne-Huntington section of the Lafayette Division.

Metal, Coal and Material Prices

Metals—New York	Aug. 12, 1924
Copper, electrolytic, cents per lb.	13.625
Copper wire base, cents per lb.	15.50
Lead, cents per lb.	7.75
Zinc, cents per lb.	6.54
Tin, Straits, cents per lb.	51.625
Bituminous Coal f.o.b. Mines	
Smokeless mine run, f.o.b. vessel, Hampton Roads, gross tons	$4.20
Somerset mine run, Boston, net tons	2.075
Pittsburgh mine run, Pittsburgh, net tons	1.875
Franklin, Ill., screenings, Chicago, net tons	1.70
Central, Ill., screenings, Chicago, net tons	1.625
Kansas screenings, Kansas City, net tons	2.50
Materials	
Rubber-covered wire, N. Y., No. 14, per 1,000 ft.	$5.35
Weatherproof wire base, N. Y., cents per lb.	18 00
Cement, Chicago net prices, without bags	2 20
Linseed oil (5-lb. lots), N. Y., per gal.	$1.05
White lead, in oil (100-lb. keg), N. Y., cents per lb., carload lots	11.625
Turpentine (bbl. lots), N. Y., per gal.	$0.90